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Winter Mining at Fairbanks

By Hubert I. Ellis*

SYNOPSIS—Surface operations form the principal field for differences between summer and winter operations, but underground there are a few differences. Steam pipes have to be carefully wrapped to guard against excessive condensation, and pumps have to be carefully handled. Dumps are thawed by means of long sweaters, forced into the material. Sluicing methods are described in detail.

Although winter mining at Fairbanks, Alaska, differs from summer operation chiefly in the methods employed at surface, there are also important differences in the procedure underground. As a rule, winter mining is on a less elaborate scale and less time and expense are taken in opening up, or developing, the body of pay. The area to be stoped is smaller, most winter dumps mined in recent years consisting of gravel from pillars and other isolated blocks not large enough to justify the heavy development expense necessary for summer work. Since all the gold in the gravel is locked up in the dump until water runs in the spring and most operators have a limited bank account, it is not the usual practice to employ more men than is absolutely necessary, many mines being worked by four or five men on a coöperative basis, with perhaps as many more wage-workers during part of the winter. Another thing militating against extensive winter mining—by which is meant the storage of pay gravel at surface as distinct from prospecting and development—is the fact that it takes nearly all winter to find the pay and open it up on a large scale for summer work.

FIG. 1. SLUICING GRAVEL AT THE ALASKA FIELDS; HAND METHOD OF MOVING THE MATERIAL

Plan of Operations for Winter Work

The shaft is sunk in the usual manner, but is rarely timbered except that a light square-set may be inserted at the station. To avoid the cold as far as possible, it is a good idea to place the sump and pump a short distance from the shaft, but this frequently is not done. Drifts are usually short, rarely extending more than 100 ft. from the shaft, and less pains are taken to keep the working faces regular and of as great extent as possible. The cold air from the surface is sufficient to overcome the heat of the steam line and points for a considerable distance from the shaft, and it is often possible to work without timbering the drifts. On account of decreased sloughing and the smaller area of roof exposed for slabs to form, it is likewise easier to start stoping at the shaft, leaving a suitable pillar to be robbed later, and to work

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outward in all directions. Transport underground, owing to the small scale of operations, is usually by wheelbarrow.

Steam pipes must be wrapped or otherwise insulated to guard against excessive loss from condensation, and great care is essential to keep water from freezing in the pipes and bursting them. The pump, too, should be handled with care; it is sure to be refractory on a cold morning—and all mornings are cold in winter—and to require thorough warming with steam before it can be induced to start.

In the fall, before snow has fallen in any quantity, the site for the dump must be prepared at surface. If an old tailing pile happens to be in just the right place, it makes an excellent foundation; otherwise the brush and moss must be removed over an area as large as the dump is expected to occupy. The gin-pole is placed a little back from the center of this circle to make the bucket dump in the center. To avoid unnecessary rehandling of the gravel in sluicing, it is dumped over the sluice boxes, which are placed as near the ground as possible. If there is sufficient grade they are sometimes set in shallow trenches, which are easily dug in the brittle surface muck. Sometimes, however, the boxes must be raised several feet from the ground, in which case they are

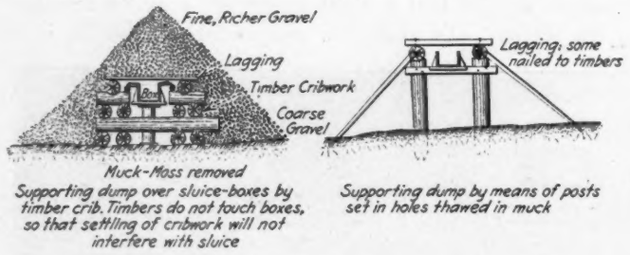
Fine, Richer Gravel
Lagging
Timber Cribwork
Coarse Gravel
Muck-Moss removed
Supporting dump over sluice-boxes by timber crib. Timbers do not touch boxes, so that settling of cribwork will not interfere with sluice

FIG. 2. THE GRAVEL PILE

FIG. 4. THE DUMP SUPPORT

protected by a cribwork of logs with removable top lagging, as shown in Fig. 2. Two or three sets, or strings, of these boxes are used in order that the gravel may be sluiced with the smallest possible amount of work. It is not customary to place riffles in those boxes immediately under the dump, but to use the so-called "false-bottom" boxes, which are merely sluice boxes with 1-in. boards to protect the bottoms, and which may be set with a grade of 6 or 7 in. or less to the box length where 9- or 10-in. grade is required for riffled boxes. Since there is almost always an abundance of water while the winter accumulation of snow is thawing, the sluice boxes themselves will run with less grade than usual; they are not ordinarily placed in position, however, until spring. Short ditches anywhere along the hillsides will usually collect all the water required, and these are best excavated in the fall before snow begins to fall; in fact, that is regarded as the best time for all ditch construction. The ditches to collect water for sluicing a winter dump need not be large, since they usually have such grade that they are able to cut their own channels through the muck.

Classification Resulting in Building a Dump

As hoisting proceeds the dump piles up as a large cone. The biggest rocks roll farthest when the bucket dumps and collect at the bottom in a constantly expanding ring. Consequently there is a rude sort of classification, the bottom of the dump being composed of coarser, lower-grade material than the rest and the richest part being at the apex and directly below it. For this reason and for the additional reason that the bottom is generally below the boxes and requires elevating before it can be sluiced, the lower 2 or 3 ft. of the dump is often left if it does not show good values by panning, only the richer portion being sent through the boxes.

One disadvantage of the winter dump is that it must be thawed again in the spring. The sun would of course thaw it in time, but this would take so long that, aside from the matter of the loss of time, there would be no water for sluicing. Thawing is usually done by means of long "sweaters" of ¼- or ⅜-in. pipe, which are easily driven into the loose, poorly compacted material with light wooden mallets. Sometimes a sweater strikes a rock and has to be withdrawn, but it does not take long to insert it again. Each successive addition having frozen before it had a chance to settle and considerable snow

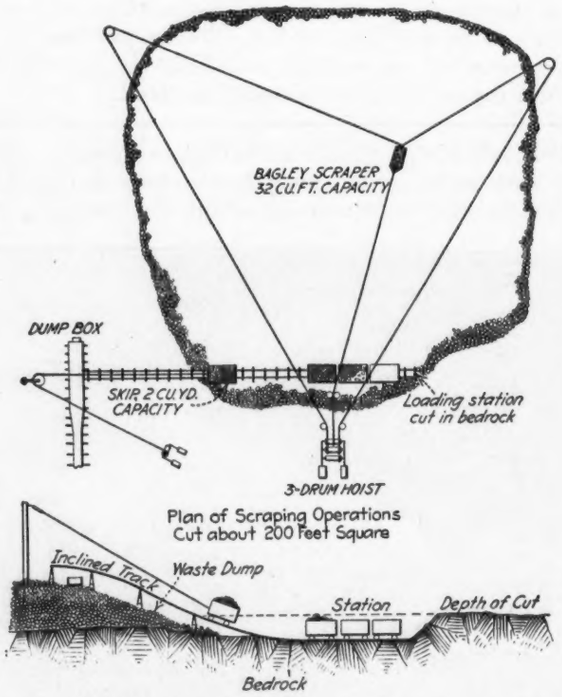

FIG. 3. DIAGRAM OF TYPICAL SCRAPING AND LOADING OPERATIONS

having fallen and been included in the dump, there is naturally a large proportion of voids; hence, when the dump thaws, it slumps heavily and loses its regular conical outline.

In sluicing, the lagging over the boxes is removed, one piece at a time, by means of a sharp pick and the gravel is allowed to fall into the boxes just rapidly enough to keep from clogging them. This work always starts at the lower end of the dump, since the boxes might otherwise clog underneath, where it is difficult to open them. All the gravel that will fall in having been sluiced, as much more as convenient is raked in by picks or pushed in by shovels.

When it becomes impossible to take further direct advantage of the force of gravity, there are several alternatives, among which the operator may choose. One of these is to drive into the boxes by hydraulicking with a small pump and suitable nozzle as much as possible of what gravel is left; this is probably cheapest for large dumps.

Another is to shovel the material into the boxes, using wheelbarrows for the final stages if they are of any advantage. If the boxes are set nearly flush with the ground, it may be feasible to use a horse or power scraper for the lower portion of the dump.

Disposal of the Washed Tailings

Since the boxes are always set as near as possible to the ground, there is rarely room for the free discharge of tailings. A place may be prepared for them in the fall by ground-sluicing away some of the muck, but this is not often done and is rarely adequate. In most cases the tailings require handling by some method or other. If the ground slopes fairly steeply and the dump is not large, room may be obtained by keeping a man constantly at work in the tailings, since he can spread the gravel out over a large area by simply pushing it around with a shovel while the sluice-head of water is running and by adding new boxes from time to time. Where the tailings problem is more serious, horse scrapers or small power scrapers are sometimes used with excellent results.

The chief advantages of winter mining are the following: Less cost for shaft, since it does not need to be timbered and may therefore be smaller; smaller cost of driving tunnels, for the same reasons; greater ease of obtaining fuel, machinery and other supplies while snow is on the ground; and the possibility of obtaining gravity water for sluicing at small expense on some claims where it is impossible to obtain it at all during the dry season. The disadvantages, compared with summer operation, are: The gold is not immediately available and it is difficult to form accurate estimate of the tenor of gravel; much time is taken to sluice the dump in the spring, which is in addition to the time required for mining and sluicing the same gravel in summer; the dump must be rethawed and rehandled, involving great expense aside from loss of time; and the tailings must also be rehandled, making the third time for much of the gravel.

Winter mining is especially adapted to coöperative work on small isolated blocks or pillars, to narrow and irregular paystreaks, and to those creeks where it is difficult or impossible to obtain an adequate and dependable supply of water in summer.

It may be noted, in reference to winter mining, that some operators have been able to continue sluicing till December or later by returning the sluice water to be used again and again. The exhaust of the pumping engine, if turned into the discharge of the pump, helps materially to keep the water from freezing. A small amount of fresh water must be obtainable from a creek or ditch, however, to replace the inevitable loss. This method is not suitable for general adoption, and it is probable that the muddy water greatly increases the loss of fine gold.

FIG. 5. OLD METHOD OF WORKING OPENCUTS, USING WHEELBARROWS TO DUMP INTO CARRIER BUCKET

Opencut Mining and Its Variations

Owing to the depth to bedrock on most creeks, opencut mining did not attain any great importance in the Fairbanks district until the power scraper was introduced. Except for Fairbanks Creek, and upper Goldstream and its tributaries, the only ground suitable for surface work is at the extreme heads of the creeks, where paystreaks are narrow, irregular and generally low-grade. Some of this ground was mined in the early days, and a little is still mined by shoveling directly into the boxes. The gradient of the creeks is so low that it is necessary to place the boxes as high as possible, naturally increasing the difficulty and expense of shoveling, to avoid undue trouble with tailings; and in some cases the pay has been hoisted by windlass or the tailings removed by horse

scrapers. These narrow, shallow paystreaks are usually in the creek bottoms, and excess water during wet weather is likely to cause considerable trouble unless a large drain is dug on bedrock to keep the cut dry. It is necessary, near the heads of the creeks, to store the water in dams during dry weather, and even then it may not be possible to operate at capacity.

If the depth to bedrock is more than 6 or 8 ft. it is obviously necessary to elevate the gravel by some means; and if the paystreak is more than 20 ft. wide the gravel must be conveyed to the boxes or the boxes must be moved from side to side. The wide, shallow deposits of Goldstream and its tributaries were the first to be worked on an extensive scale by opencut methods, and the operators here hit on the scheme of combining drift mining and opencut mining by using buckets and automatic carriers in conjunction with wheelbarrows. The buckets dropped into sumps cut in bedrock and were filled from wheelbarrows; they were then hoisted up the inclined trolley-cables and dumped into the mud-boxes. Except for the smaller amount of development work required, less expense for thawing and the greater convenience of working in the open air, this process had little advantage over drift mining. Cost of digging bedrock drains or pumping out rain and seepage water, cost of removing overburden, delay when waiting for ground to thaw in spring or cost of thawing in order to expedite operations, and less efficient work of laborers hampered by rain, sun and mosquitoes—all these tended to place total costs more nearly on a par with those in drift mining.

The next step in advance in opencut work involved the use of small slip scrapers drawn by horses. On account of the high cost of equine power in a region where all feed must be transported thousands of miles at great expense, this method was important chiefly in that it paved the way for the power scraper. Double-drum engines succeeded the horse as the source of power; the main drum served to drag the loaded bucket forward while the other took the empty back. The drums operated by friction and reverse gearing, so that when the main drum was pulling the other was free to revolve in its bearings, and *vice versa*. By shifting the tail-block the scraper could be made to dig at different points in the cut. Holding the handles of a light scraper attached to the drum of a powerful engine was something worse than attempting to master a bucking horse, or so the workmen complained, and a substitute scraper, less dangerous to life and limb and at the same time capable of taking a larger load, was sought.

The Scraper and Methods of Using

In recent years the slip scraper has dropped from use and its place has been taken by the Bagley scraper of the bottomless or of the wheel type. These scrapers are operated by double-cylinder three-drum hoists, of which 15 were working in the Fairbanks district in 1914. Thirteen were on Goldstream and its tributary, Pedro Creek, one was on Fairbanks and one on Cleary. The smallest had 7x10-in. cylinders, the largest 10x12. Twelve were "Americans," made by the American Hoist and Derrick Co., of St. Louis, and three were made by the Washington Iron Works, of Seattle.

The usual practice is to have the dump box and sluice boxes at one end or side of the cut, on a timber trestle at sufficient elevation to discharge the tailings freely. The Bagley scraper, having obtained its load, is dragged up an inclined approach to the dump box, where it discharges automatically, the teeth engaging a timber and causing the scraper to turn bottom up. By means of two tail lines and suitable leads, as shown in Fig. 3, the scraper can be dragged back to any desired position in the cut. The overburden of muck is usually removed by "ground-sluicing" and the barren gravel is scraped into a pile at one side if there is room. The pay-gravel and as much of bedrock as carries gold, unless it is too difficult to move, are then scraped into the boxes. Details of operating vary, of course, at different mines, but a brief description of the more important features of a typical mine will illustrate the practice.

The ground was about 16 ft. deep, with 13 to 14 ft. of overburden and 3 or 4 ft. of pay. The upper 6 ft. of the deposit, being muck, was removed by ground-sluicing. The rest of the waste was scraped out, and owing to lack of a site for storage much of it was sluiced at considerable expense. The creek was diverted and carried past the cut on the left limit, the pay being chiefly on the right limit. This was not a difficult operation; the new channel was merely started in the muck and the creek was forced to do most of its own cutting. The area covered by the cut was about 40,000 sq.ft., about half of a normal season's work. The engine was of the ordinary three-drum type with 8x10-in. cylinders, and the scraper had a capacity of 32 cu.ft. The scraper dumped into a car set in a station cut in bedrock; the car held 2 cu.yd. and was of the skip pattern. It was raised on an inclined track to the dump box by means of a separate engine. This was the first time a car was used in scraper mining at Fairbanks for elevating the gravel to the sluice boxes, but the saving in fuel was so great that the method will be widely copied.

After the waste had all been removed about 1,000 sq.ft. of bedrock was stripped a day when everything worked smoothly. The average crew consisted of 12 men for two 10-hr. shifts, except in cleaning bedrock, which was done by hand and required several extra men. Three cords of wood were burned per shift of 10 hr. at a cost, when delivered during the winter, of $10 per cord, ranging up to $14 when delivered in summer. The total operating cost per shift was about $89, divided as follows: Engineer, $9.50; fireman, $7.50; dump-box man, $7.50; three extra men at $6.50 each, $19.50; wear and tear on machinery and depreciation, $15; wood, $30. The recovery, stripping, 1,000 sq.ft. running 50c. per sq.ft., was about $500 a day. The cost of erecting plant, removing overburden, etc., is a large but variable item in scraper mining. At this particular mine it was nearly 35c. per sq.ft. last season, as against about 10c. for mining the pay itself. This was the first season's work, however, and many unforeseen difficulties arose, not the least of which were a very backward season and continued bad weather; it is hoped to get costs down to 25c. per sq.ft. in the near future, equivalent to 42c. per cu.yd., waste and all, or about 60c. per yard of gravel handled.

Cost of Instituting Operations in Gravel

Starting on a new claim and buying new machinery the total expense on such ground as that described, before sluicing of pay begins, is not far from $12,000. In order to win a profit the operator must have at least three or four years of work on material yielding 50c.

per sq.ft. of bedrock. Aside from labor, the largest single item entering into the cost is fuel, which may be $60 a day when two shifts are working, of a total operating cost of $188 a day. Cheaper power is of even greater importance here than in drift mining, and the continued prosperity of the industry depends on the construction of a central power plant or the importing of a cheaper fuel. Unlike drift mining, opencut mining by scrapers offers a growing market for electric power, for there are outside the Fairbanks district proper many shallow, low-grade deposits that can undoubtedly be worked at a good profit by this method. On many of these creeks the gravel is 6 to 10 ft. deep and there is very little muck overburden. Under present condition this can be mined for about 60c. per cu.yd. With cheaper power, cheaper labor and cheaper freight, all consequent on the construction of the government railway, this cost should easily be reduced to 40c. and can probably be cut to 30c.—about 10 or 12c. per sq.ft. of bedrock.

The matter of cost is always one of great interest. Unfortunately the operators at Fairbanks do not keep records that make it possible to determine detailed costs or even, in many cases, the total. It is therefore impossible to do more than make a rough guess, and this would place the average of the entire district at about 75c. per sq.ft. of bedrock, with a minimum of 50c. and a maximum of $1.25. The following figures, which are estimates of the cost of working a certain block of ground on Engineer Creek a year ago, may be of value as showing in a general way the weight of the principal items:

COST OF MINING OPERATIONS

Development	
Bunkhouses, messhouse, cost of setting up plant	$1,500
Shaft and station (90 ft. to bedrock)	2,500
Main drifts, 400 ft. at $4	1,600
Crosscuts, 200 ft. at $2.50	500
Incidentals	600
Total	$6,700
Cost per sq.ft. developed, at 40,000 sq.ft.	17c.
Mining	
16 shovelers, 2 carmen, 1 fireman, 2 extra men, at $5	$105
Engineer, blacksmith, pointman, at $7	21
Dump-box man	6
Board, at $2.25 per man per day	58
Fuel, 3 cords at $8	24
Wear and tear and depreciation on plant	10
Total operating cost per day	$224
16 shovelers, each stripping 35 sq.ft. per day, sq.ft.	556
Cost per sq.ft.	40c.
Total cost, including development, per sq.ft.	57c

It may be noted that this ground is more easily worked than the average in the district, that fuel costs less, and that the points require less attention and less steam. Water for sluicing must be pumped, however, and must be returned during most of the summer. Owing to a desire to be on the safe side, in the absence of reliable figures for other mines, these costs should be slightly reduced in operation. Unfortunately, the ground passed into other hands and there was no opportunity to check the above estimates.

Duty Concerning Belt Repairs

By A. L. H. Street*

An experienced employee in a Missouri ore mill was injured while assisting in shortening a belt that operated a mineral pump, owing to his arm being drawn into the pulley, which was not stopped. A suit against his employer resulted in a judgment for $1,000 damages, but the St. Louis Court of Appeals recently reversed the award on the ground that negligence had not been established. (Chandler vs. St. Joseph Lead Co., 178 Southwestern Reporter, 217.) The view of the higher court is expressed in the following language:

> The master is not an insurer of the safety of the servant and, within the limits of ordinary prudence, may conduct his business in his own way. There is here no negligent order or command to the servant. No one directed plaintiff to repair this belt, but he did so of this own initiative, in a manner of his own choosing and without requesting anyone in authority to stop the machinery. . . . . An employee performing the duties assigned to plaintiff was expected by the defendant to make such repairs. But the evidence is that the task in which plaintiff was engaged when injured was one which could be safely performed if reasonable care was employed. And plaintiff, by reason of his long experience, possessed the requisite knowledge and skill for the proper performance thereof. The master may intrust to the servant the performance of the ordinary and simple duties incident to the servant's employment and resting upon the latter's knowledge and skill. And the master has the right to assume that the servant will exercise ordinary care in the performance of such duties.

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Stellite, a Cobalt-Chromium Alloy of Great Hardness

In a paper read before the annual meeting of the American Institute of Metals, Sept. 30, 1915, Elwood Haynes described some of the characteristics of stellite, a binary alloy consisting of cobalt and chromium, which was discovered by him and produced as early as 1899. Its principal property is a considerable hardness, since alloys containing 10% or more of chromium could not successfully be filed, but the file could slowly wear away the surface of the metal. It also has considerable toughness. Alloys containing as high as 25% chromium show an elongation of 10% or more. Its tensile strength and elastic limit are comparatively high, a bar of metal showing elastic limits of 85,000 lb. and a tensile strength of 110,000 lb. The color of the alloy lies between that of steel and silver. It is resistant to oxidation or other changes when exposed to either dry or moist atmosphere at all temperatures under a dull-red heat.

The combination has been used particularly as a cutting tool for steel and iron. Its virtue for such a purpose lies in its ability to maintain its cutting edge at a high rate of speed at temperatures which would immediately cause the failure of any known tools containing any notable quantity of iron. Owing to the fact that it retains its hardness even at a full-red heat, it cannot be forged.

Stellite can only be reduced to a desired form by casting it in dies in the form of bars which are afterward ground to a cutting edge. It was recently ascertained that a $\frac{3}{8}$x2$\frac{1}{2}$-in. piece of stellite ground to the form of a grooving tool cut 14,000 grooves in cast-iron pistons ranging from 3$\frac{1}{2}$ to 4$\frac{3}{8}$ in. in diameter before it became too much worn for further use. This work was done in regular practice and not as a test. A stellite tool of the same dimensions, but which was ground to round-nose form and used for turning pistons, turned off more than 8,500 lb. of cast iron before becoming too short for use. Considering only the portion of the tool that was actually ground away, the tool turned off 1,000 times its weight of cast iron before becoming too short for service.

There are combinations made for turning steel and others for turning cast iron. Those for turning steel are now being used extensively for making shrapnel shells at high speed.

Potassium Salts: An Economic Geological Study--II

By E. Mackay Heriot*

SYNOPSIS—In continuation, the characteristics of the Stassfurt and Hannover deposits are discussed, also the Alsatian deposits. The probability of the discovery of new deposits is examined and explained.

I am going to divide the German potassium deposits into two types: The Stassfurt and the Hannover, for there is a considerable difference between them.

In the Stassfurt type the upper Permian contains from 20 to 30 m. of massive red clay with anhydrite balls and some rock salt, then from 0.3 to 3 m. anhydrite. The following Permian contains 50 m. rock salt; 1.5 m. anhydrite with rock-salt crystals; 5.15 m. red massive clay with anhydrite balls and rock salt; 100 to 150 m. younger rock salt; 40 to 50 to 90 m. main anhydrite; 4 to 10 gray salt clay; 30 to 40 m. carnallite region; 20 to 40 m. kieserite region; 40 to 60 m. polyhalite region and 300 to 500 m. older rock salt (anhydrite region). The middle Permian contains 70 to 100 m. older anhydrite with inclosed layers of bituminous dolomite slate, so-called "stinkslate," and with one or two salt beds of from 10 to 15 m. The lower Permian contains 4 to 10 m. Permian limestone; 0.5 to 4 m. copper shales; and Permian conglomerate. The copper shales referred to are those of the celebrated Mansfeld copper mines.

In the Hannover type of deposit the upper Permian contains up to 250 m. rock salt, with at about 50 m. a small potassium layer; 30 m. younger main potash bed; 20 to 40 m. rock salt, sometimes with a small potassium layer; up to 1 m. intermediate anhydrite; 5 m. red massive clay; 30 to 50 m. younger rock salt; 40 m. main anhydrite; 4 to 5 m. gray salt clay; 3 to 30 m. older potash bed; up to 60 m. of kieserite region and some older rock salt.

The middle Permian has older anhydrite with layers of bituminous stinkstone.

The Stassfurt type is well-known and has been carefully studied, but the Hannover type has not. It has a confused build, which makes a clear study all the more difficult.

First and foremost, the absence, in many localities, of the gray salt clay and main anhydrite layer is unfavorable. Only here and there mixed pieces show its presence. It will be remembered that when I described how these formations originated, I said that after the potassium salts had been precipitated, the salt clay was formed. This salt clay has been the preserver of the easily soluble potash salts, and its absence in the Hannover mines gives rise to unfavorable ideas.

The thickness of the older rock salt is not yet known in the Hannover type. A kieserite and polyhalite region, as found in Stassfurt, is not met with here. Then again there are no potassium salts in the younger rock salt. At Stassfurt we find the older rock salt marked with year-rings, and in the Hannover the younger rock salt is well marked with year-rings of anhydrite. In the Hannover mines one finds also rock salt, sylvine and carnallite in fissure veins.

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As examples of the Stassfurt type I give sections of the Stassfurt-Leopoldshall mines,[1] Solwayhall, near Bernburg and Vienenburg im Harz. In the former, one sees the Trias formation covering the Permian is made up, from top to bottom, of gypsum, salt-clay carnallite region, kieserite region, polyhalite region, and last the older rock salt or so-called anhydrite region. In Solwayhall it is nearly the same, except that the younger rock salt fails at certain points, and hartsalt is found above the carnallite. The anhydrite has not changed to gypsum as is the case at Stassfurt. At Vienenburg the succession is normal, only the carnallite has been partly altered to sylvine.

Of the Hannover type I give Wilhelmshall am Huy.[2] We see a large mass of older rock salt, limited on one side by sylvine, carnallite, salt clay and anhydrite and on the other side by carnallite, salt clay and anhydrite. At the top the kainite forms a cap on the carnallite. The younger rock salt is considered as a secondary mineral, having been deposited by solutions which received their salt from other salt formations. Carnallite, the best-known of the potassium minerals, is the originator of most of the other secondary minerals such as sylvine, kainite, sylvinite, etc. It must be accepted that only a small part of the potassium minerals are of primary origin. On the other hand, most of the primary salts occur as secondary minerals. At certain localities the secondary minerals form the chief mass and the primary minerals are only present in small quantities. The accompanying table by Lowe shows the occurrence of primary and secondary minerals:

OCCURRENCE OF MINERALS

Without Exception Anhydrite	Chiefly Primary	Seldom Primary
Gypsum	Rock salt	Sylvine
Salt clay	Polyhalite	Kainite
Douglasite	Kieserite	Schonit
Boracite	Carnallite	Langbeinite
Hydroboracite		
Sulphoborite		

I must leave the Permian era for a time, and will now show salt layers in other geological formations. The most important, next to the Permian occurrences, is the new find in Alsace, near the French border. Borings at Niederbruck in Upper Alsace tapped the upper layer of potash salts 154 m. thick at a depth of 358 m. The lower salt-bearing stratum had a total thickness of 327 m. and was cut at 620 m. Many borings have cut the salt formation, and a large area has been proved.

In 1913 shipments began from Alsace and reached over 500,000 tons. The salts were really discovered when boring for oil. In 1909 the first shaft was finished. Over a dozen mines are now at work. They represent 4% of the total German output. Up to the present the salts seem to underlie about 7 sq.mi.

The Alsatian Potash Deposits

From a geological point of view the Alsace occurrence is similar to that of Kalusz (Austria), which I shall describe later on, and very different from that of Stassfurt. The Alsace deposit occurs in the Oligocene. A boring at

[1] See "Eng. and Min. Journ.," Oct. 23, 1915, p. 670, for the gelogical section.

[2] Ibid., page 671.

Wittelsbach was put down to 1,119 m., and from 0 to 358 m. the ground traversed was gravel and marl; from 358 to 512 m., salt marl; after 358 m., 3 beds of rock salt and anhydrite, and at 473 m. a 5-m. bed of potash salts. Then came various beds of rock salt, anhydrite and dolomite, then a hundred meters of greenish-gray marl schist. There seems to be a marked absence of carnallite and chloride of magnesia. The question is, Does the Alsace basin cross over into France?

Potash salts have been found near Salzgitter in Germany. I give a sketch of this occurrence which pertains to the Triassic era.[3] The salt is 280 m. thick and contains carnallite and kieserite. Fossils of the Rot have been met with and prove a sea deposition.

The salt deposits of Bochnia and Wieliczka lie along the slopes of the Carpathian range of mountains. No potash salts have as yet been found here, but otherwise the geology is exceedingly interesting and I give a section of the Wieliczka mine.[4] The local strata are divided into two epochs, a younger and an older. The former is composed of sand and clay with gypsum, and pertains to the upper Miocene with *ostrea digitalina* and *cerithium lignitarum*.

The older formation is the rock-salt series. In Wieliczka the salt lies directly under the gypsum clay. It is quite clear that the salt is of lower Miocene age. The deposit is 3½ km. by 0.8 km. and about 150 m. in depth.

Beginning at the top is the salt clay, then salt sandstone, clay, anhydrite and rock salt. The rock salt is classified as Spiza salt, of fine crystalline structure; Szybiker salt, which is coarse-grained; and green salt, which is also coarse-grained and of a greenish color.

Fossils and Salt Deposits

Within the stratified salt region fossils are found, more especially in the Spiza salt, where one may say they never fail and often occur in great masses. The fauna, with the exception of a *planorbis art,* are sea dwellers and are classified into 68 species. This is interesting because in all the great German potash deposits not a single fossil has been found, and yet there is no doubt as to the origin of these salt beds. It is, however, by no means easy to explain the lack of fossils.

Will potash salts ever be found in the neighborhood of Bochnia and Wieliczka? I have found it necessary to introduce a small map of the Carpathians in order to show the positions of Bochnia, Wieliczka and Kalusz.[5] All three lie on the north slope of the Carpathians. At Kalusz, potash-salt deposits have been encountered and are being worked. The age is also lower Miocene. Kalusz lies 26 km. NE of the mountain range. The salt-bearing formation dips SW 30, 40 or 50°. There is a lower salt clay without potash salts and an upper salt clay carrying potash salts. The lower salt clay consists of thin layers of clay and salt and carries about 50% of rock salt. It has a thickness of 90 m. and has not been pierced. The upper salt clay is about 40 m. thick. In this is found a bed of kainite. Anhydrite, gypsum, carnallite and picromerite are also met with in small quantities. Above the salt clay follow gypsum and clay. The kainite is from 8 to 12 m. thick and is generally covered with anhydrite. The production of potash salts, which is about 1,000 tons annually, is not exported, but consumed at home.

[3]"Eng. and Min. Journ.," Oct. 23, 1915, p. 670.
[4]Ibid., page 671.
[5]Ibid., page 669.

The latest find of potash salts is in Spain. Carnallite has been cut while boring for rock salt at the Cardona mine, near the borders of the Barcelona-Lerida provinces. The salt is in the Miocene formation. Nothing definite is known to the public as yet in regard to the commercial value of the Spanish potash, but the government has sent geologists to make a report. In the meantime the German potash syndicate has acquired large interests.

The salt beds of the Saltrange, in the Punjab, India, are of Cambrian age, and those of Cheshire, England, of Triassic. Thus we see that potash and rock-salt formations are not peculiar to any one geological period.

Probability of New Deposits

What are the prospects of finding new deposits of potash salts? They are certainly favorable. Let us look back to a few facts already recorded. Potash beds have been encountered in Prussia in the Permian formation; near Salzgitter, Germany, in the Triassic; at Kalusz in Austria and Alsace in Germany, in the Tertiary formation. The Prussian Permian and the Tertiary occurrences at Alsace and Kalusz were doubtless formed by deposition from sea water. Thus we find that the Permian era holds no monopoly of potash salts, as was formerly believed to be the case. The Alsace find is the most striking contradiction.

It only needs certain natural conditions to form a potash deposit. First there must be a salt-water basin in which more water is evaporated than enters; and second, the potash salts which are deposited must have a waterproof covering, such as anhydrite or, better still, salt clay. Whether the basin is in intermittent connection with the ocean—the bar theory—has nothing to do with the question in general. Today one can observe the process of salt deposition in the Caspian Sea. This body of water is an inland salt sea, and its bottom is already covered with rock salt. The potash salts being more soluble, are still held in solution.

It is not likely that the German Permian sea is the only large one of its kind among the many periods of the earth's formation. There are most likely many more. Why then have such depositions not been found more often? This question is easy to answer—they have not been looked for. The Spanish potash salts were met with by accident when testing the thickness of the rock-salt bed. The Alsace potassium was found casually while boring for oil. Another such mere chance found the Kalusz salts. The Anhalt mines, the first German salt mines, were worked for their rock salt. Later, Precht discovered the value of potash salts as a manure. This gave rise to the opening up of the salts of the North German plain, the potash salts of the Permian Sea.

That the German potash syndicate, which controls the output of the German salts, is well aware that potash may eventually be found outside Germany is seen by its hurried interest in the Spanish field. Up to the present, potash salts of marine deposition, other than the German Permian, have been discovered by accident. Wherever such a find has taken place, many competitors have rushed to the scene of action and often availed themselves of a good opportunity. It would seem to me that any company laying out a considerable amount of money to discover these salts should be given a certain monopoly, or say a large area to work upon, if it were so lucky as to find them. Such a company would have to examine thor-

oughly the territory under which salt formations are supposed to exist; at the start superficially, after which drilling operations would commence.

I hardly think that a study of the relation of land to water in the different geological ages will help much. I have given, however, a sketch[6] of the German Permian Sea, connected, as it seems to be in Russia, with the ocean. On the same map will be seen the Mediterranean Sea, which is about the same size. If we look at the map of Germany, we see that the salt area extends to Hamburg on the north, to Inowratzlow on the east, to Münster on the west, and to Alsace on the south; and no one as yet knows the real boundaries of these huge salt areas.

To the west, borings were being carried out in France, near Belfort, on the chance of the continuation of the Alsace field. The map shows that potash always occurs with the rock salt, but that the former covers only a small portion of the latter. This, of course, is natural, although where rock salt is found it is by no means certain that potash salts will be present, and boring is the only way to find out where they do exist. Potash is not likely to appear in salt springs, because if it did, it would indicate that water had entry to the potash beds and they would soon cease to exist.

How Prospecting Should Be Done

The rock salt must be pierced, and then, as a result of careful observation and expenditure of sufficient capital, potash salts may also be cut. The German potash was found at considerable depths, varying from 300 to 600 m. A borehole of this depth is an expensive undertaking. It would cost about $10,000. The prospecting of a small area of country would necessitate say 10 holes and cost more than 10 times this amount. A suitable spot for the first hole would have to be found, and this might entail much pioneer work. When the likely spot was located, a contract could be made for a hole with a guarantee of, say, 600 m. depth. The class of ground and local conditions would settle the price per meter and the size of the hole at the surface. The boring should be rotary, as every meter of core must be examined. Even if the result were negative as regards salt, it would add more knowledge with reference to hole No. 2.

A mining engineer with considerable experience in potash-salt prospecting should be placed in charge and the advice of local geologists taken advantage of; but the engineer should be allowed to determine the position of the holes. Those who have spent several years at this work will understand what this means. In Germany during the potash boom geologists sprang up in many corners; even chemists who had no knowledge of geology drove up to the boreholes and gave their opinions of the cores. In many cases the engineer who was most competent was not asked to give an opinion. In those days boring syndicates were formed overnight, perhaps by needy gentlemen after a good dinner.

A representative drove out to see the landowners, who in Hannover have the mineral rights. The landowners were generously treated to beer and schnapps, and when they had had considerably more than was good for them, a contract was agreed to. Today this matter is not so easy. Chance sometimes brought luck and the value of shares would rise from a few dollars up to $700 in one night; but there were plenty of failures.

In Prussia he who bored the rock salt first had a right to the potash salts also. Therefore in Prussia boring was carried out in competition. The writer has taken part in many interesting borings both in Prussia and Hannover. A sketch of the ground pierced by one of these borings I superintend in the Eichsfeld basin is given.[7] No one thought that the potash salts discovered in the plains would continue under the Muschelkalk Mountains. It will be seen, however, that these are mountains made by erosion and that the stratification lies concordant with the underlying strata. Thus it needed only some geology applied to mining, and I give this example for that reason. Again, look at the section of Wilhelmshall am Huy. If the hole was sunk on the left-hand side, an immense amount of kainite and carnallite would have been indicated, and as it is a question whether the dip could have been observed, it might have been taken for the width of the layer.

The engineer anyway would have to report the length of the potash cores. Subsequent mining would prove that the stratification was "on end." This is often the case in the Hannover type. If the drill had passed only a little more to the left, no potash salts would have been found.

As a detail of boring, care must be taken to use magnesium chloride instead of water when in the salt region. Water leaches out the rock salt, but it would in a short time completely dissolve the potash cores before they reached surface.

Boreholes Must Be Carefully Refilled

It takes nearly as long to fill up a hole as it does to bore it, that is to say if it is done properly. In Germany this is a most important item and government engineers establish special regulations for the procedure and see that their orders are carried out. In the salt region the hole is filled with baked clay balls. A certain number are thrown in per minute and stamped at given intervals. This is done in order to safeguard the potash beds against the intrusion of water. All shafts sunk for this industry are circular in form and watertight. In Germany two shafts are obligatory for the safety of the men. I have described the methods of sinking these shafts in previous pages of the *Journal,* and there is nothing new to relate. The cost of a shaft under average conditions is about $150,000, but if much water or quicksand is encountered the cost may be much higher. One may say that this class of shaft sinking has reached a very high standard in Germany, thanks to the modern potash-salt industry.

In this article I have endeavored to show the importance of the potassium-salt industry, its main geological features and the chance of its extension in the future. I will now give some of the principal conclusions at which I have arrived:

1. As far as can be seen the only considerable source of potash is marine depositions in the form of beds of Tertiary or earlier age.

2. That the chance of finding such deposits is good provided prospecting and boring are carried out to great enough depths at suitable places. It is to be remembered that up to the present, potash salts, outside of known areas, have been found by chance.

3. That the present consumption of potash salts is only a small part of what the world really needs.

4. That on account of these facts governments should offer special facilities for prospecting.

[6] "Eng. and Min. Journ.," Oct. 23, 1915, p. 672.

[7] Ibid., page 671.

Minerals of Asiatic Turkey

SYNOPSIS—Northern Asiatic Turkey contains a wide variety of minerals of economic value. Among the important resources of the region are copper, mercury, antimony, iron, manganese, chromium, coal, petroleum, borax, emery and meerschaum. These deposits have long been worked in primitive fashion, but political conditions have delayed modern exploitation. Some of these supplies, especially copper, are now badly needed by Germany, and feverish activity in certain mines would doubtless follow the cutting through of "the road to Turkey."

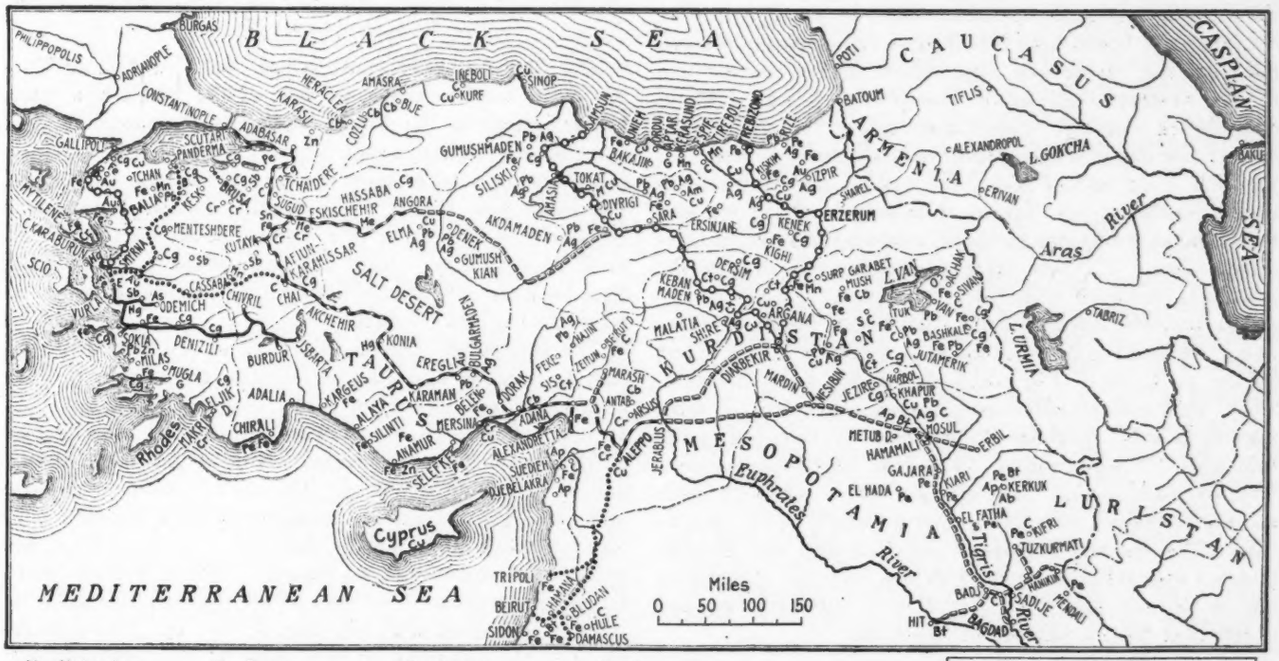
Should the Germans succeed in hewing a road through to Turkey, a mineral empire of the first magnitude will be opened up to the Teutons, one which contains some rich though little developed deposits of copper—a metal of prime importance to the Central Monarchies.

The mineral resources of northern Asiatic Turkey are important and varied, but these deposits have lain practically dormant for centuries, largely owing to the inability of anyone to exploit the deposits without being themselves exploited. The heavy government fees and the lack of transport facilities have also retarded the mineral development.

The copper resources, while not great in the sense of some modern mines, are of special importance to the Central Empires, which happen to be deficient in deposits of this indispensable war metal. The high grade of the Turkish copper deposits might permit of their being useful in case the present conflict becomes protracted, and in any event would be a valuable asset to the Teuton empires in future wars. The varied mineral deposits of the Turkish peninsula form one of the links in the chain of strategic resources that will be connected up by a Teutonic victory in the Balkans. It therefore seems likely that the Allies, even though they give up the Dardanelles project, will do their utmost in blocking "the road to Turkey."

The accompanying map, based on one by Leon Dominian, reveals to what a large extent mineralizing agencies have been at work in the peninsula of northern Asiatic Turkey. The process of ore deposition[1] appears to have been heaviest in the three zones of major folding which encircle the elevated barren plateaus of the interior. Metalliferous zones and mineral belts are farily well outlined by the cartographic distribution.

The complex metalliferous regions of Anatolia[2], of the east Pontic range—extending from the coast inland between Unieh and Trebizond—and of the upper basin of the Tigris constitute fields that bear promise of interesting developments when results of detailed investigations become available.



MAP OF NORTHERN ASIATIC TURKEY, SHOWING DISTRIBUTION OF MINERALS—AFTER DOMINIAN, 1913

Asia Minor as a human habitation is very old. The economic value of various minerals was duly recognized

[1]Excerpts from "Cartographic Documents of Economic Geography," No. 2, 1913. Geographischer Kartenverlag Bern, Berne, Switzerland.

[2]The term "Anatolia" is employed here in the sense generally accorded to it by European writers, whereby it refers to the western section of Asia Minor. The Turkish name "Anadolu" is used, however, by the Turks and Turkish-speaking races to designate the entire peninsula.

within the peninsula throughout ancient times. In the heyday of the vanished kingdoms of Sumer and Akad, throughout the supremacy of the Babylonian Empire, as well as at the height of the Hittite and Mycenean powers, mining had assumed sufficient importance to have become the means of sustenance of the inhabitants of numerous settlements scattered between the Ægean coastland and the Persian Gulf. During Byzantine and Ottoman sway the art of working ores was also carried on profitably. From the Seventeenth Century to our day, however, the industry gradually declined. Some attempts have been made in the past decade to revive it; in a few instances, as at Balia in the western end of the peninsula, success has attended these endeavors. In general it should be noted that mining in recent years has been mainly confined to the districts lying close to the coast.

Coal Widely Distributed in Asia Minor

Coal is of widespread occurrence in Asia Minor. The northwestern projection of the peninsula forms part of a district wherein lignite deposits have been worked in a number of localities. The lignitic beds occur mostly in Tertiary lacustrine deposits and appear to belong to a zone of transition between the Miocene and the Pliocene. The southwestern coast of Asia Minor, with its hinterland, does not appear to be devoid of coal. In the Province of Smyrna, the Sokia and Nazili beds have been developed for local use. Coal was mined about half a century ago in the northern section of Mesopotamia, near Jesireh. Some work was also undertaken in the Hamrin mountains. The deposits near Mosul have not been worked. In the hills lying east of Kifri, the natives indulge in occasional desultory exploitation of this fuel. In Syria and the Lebanon a number of native exploitations are encountered. Some of these were undertaken to supply the small silk factories with fuel.

The best-developed Turkish coal field is found at Heraclea. The coal is bituminous and occurs in a belt about 60 km. in length. The coal beds outcrop near the coast. They overlie Carboniferous limestones and are in turn unconformably overlain by Cretaceous beds of great thickness. The output for 1912 from this field exceeded 700,000 metric tons. Occurrences of bituminous coals are also reported from the eastern section of the peninsula. The district between Lake Van and the Persian frontier appears to be favored in this respect. Anthracite has never been mined in Asia Minor, but its occurrence is reported from a number of localities.

Gold Mined by the Ancients

Little gold is produced at present, but the precious metal is known to occur at Serjiller, south of the Dardanelles. The abundance of gold jewelry found in the excavations on the site of the several cities of Troy indicates a large production from near-by localities. An ancient locality which was famed for its gold mines was Astyra, the site of which is now marked by mines that existed at the time of the explorations of the Greek geographer, Strabo.

The valleys of the Hermos and the Pactolus, in Anatolia, have been the site of ancient placer mines. How prolific in their yield of the precious metal the gravels of these rivers must have been may be inferred from the frequent allusions in ancient literature to the gold-bearing sands of the district, now known as the valley of the Gedis River. In recent times peasants living in the vicinity of Boz Dagh (Boz Mountain) make a scanty livelihood by washing the gravels brought down by the rivers.

The environs of Izpir in the east Pontic area contained gold fields that are known to have been worked from the Third Century B. C., to the end of the Seventeenth Century A. D. Throughout the Nineteenth Century small quantities of gold were mined intermittently around Bulgar Dagh. This region bids fair to become the site of future producers of gold, silver and lead.

The best-developed silver-lead mines are found near Balia, at a distance of about 100 km. from the sea. The ore occurs in a contact zone between Tertiary augite-andesite and Carboniferous limestone. The contact zone varies between 2 and 5 m. in width. The limestone at the contact is silicified but barren. In the andesite, on the other hand, are found accumulations of pure galena which seem to be connected with fissures parallel to the contact zone. The ores carry galena, blende and pyrite, and as formerly mined, contained on an average from 16 to 20% Pb and 8% Zn. The last operating company was the Société Anonyme Ottomane des Mines de Balia Karaidin. The 1913 production was valued at £171,000.

Copper Mines Along Black Sea Coast and in Upper Valley of the Tigris

The two most important copper belts in Asiatic Turkey occur in the eastern portion of the Black Sea coast, as far inland as the Pontic ranges, and around Argana (Arghanah) in the upper valley of the Tigris. Copper prospects have been noted as far west as the vicinity of the seaport of Sinop. The region around Espie, near Kerasund, is the center of a district noted for its mineral yield in antiquity. Here ancient workings abound and have been the site of small operations carried on intermittently in the last 20 years.

The celebrated Argana mines, from all accounts, contain high-grade ore. These deposits are known to have been exploited since 1096 A. D. within an area of about 12 km. square. In recent years mining has been carried on by the Turkish government, both on a leasing system and by direct management. The ore is broken to nut size and undergoes successive roasting until a product containing about 30% Cu is obtained. In this form the product is transported on camels to Black Sea or Mediterranean harbors. The cost of mining and treatment at Argana is estimated at less than 3c. per lb. The disturbances of the last three or four years have caused cessation of work throughout Turkey, although it is possible that exploitation has been resumed recently under German management. The production cannot be of great importance immediately, however, as the organization of operations will require time in order to be productive in a large sense.

Mercury, Manganese, Antimony and Chrome Ores Occur in Important Quantities

Two deposits of cinnabar were working in 1913. The Karaburmu mines, situated about 30 km. from the town of Smyrna, produce about 3,000 flasks of quicksilver annually. The deposit lies in the vicinity of basaltic flows and consists of metamorphic siliceous schists impregnated with cinnabar. Mining is done entirely in opencuts on ores containing as little as 0.25% Hg. The

cinnabar appears to be concentrated in the fines, and the ore is accordingly screened. The screenings assay from 0.75 to 2% Hg. The plant at the mine comprised two double Spirek tower furnaces for broken ore and a Cermak-Spirek furnace for fines. This installation had a capacity of 30 tons per day. The other mercury deposit occurs in the vicinity of Konia. Here the ore is found in veinlets, nodules and small particles in a crystalline limestone close to schist, at no great distance from old eruptives. The mineral appears to be present whenever the limestone becomes silicified. Some stibnite is associated with the cinnabar.

Pyrolusite is mined from the Phlinika district, much of the ore produced assaying 52% Mn. At the Zengan mines, high-grade manganese ore is obtained. Manganese ore is also known to occur near the Russian frontier in the eastern Pontic area.

The two important centers of antimony production are Odemich and Jinlikaya. Ore carrying as much as 65% antimony is found in both. At Jinlikaya the veins cut through crystalline schists. Shipments were formerly made chiefly to England by way of Smyrna.

Asia Minor has contributed largely to the world's supply of chrome ore. The Turkish ores are soft, rich in chromic oxide, have a low silica content, and are free from objectionable impurities. Although the production has fallen off in recent years, the mineral is of widespread occurrence in Anatolia. The most important deposits are those at Dagardi.

Important Minor Minerals Include Borax, Emery and Meerschaum

Extensive beds of pandermite, a massive and not entirely pure variety of colemanite, are mined at Sultanchair, in the Province of Hudavendighiar. The principal operations are those of Borax Consolidated, Ltd. The mines lie on the mail route leading from Panderma harbor to Balikesser. The pandermite occurs in Tertiary sedimentaries lying in a basin surrounded by steep hills of gabbro, granite and crystalline schist. The productive beds consist of a brownish and bluish gray gypsum, containing nodules of variable sizes dispersed within the gypsum, and forming from 10 to 20% of the aggregate mass.

The production of emery from Asia Minor and the islands of the Ægean Sea practically constitute the bulk of the world's supply. The output of the former exceeds that of the latter. The mines lie in a belt extending south and southeast of Smyrna. The ore is found in lumps up to 15 cm. in diameter embedded in a red-brown clay and associated with calcite.

The plains near Eskischehir constitute one of the most important meerschaum localities in the world. The meerschaum district extends from the town of Eskischehir almost due eastward to the City of Angora. The mines lie at a distance of about 22 km. from the railroad station, to which the ore is packed by camel trains. The two chief producing mines are those of Sarasu and Sepki. The deposit occurs in a valley filled with drift material from the surrounding mountains. The sepiolite is scattered through the drift in rounded nodular masses, with fragments of magnesian and hornblendic rocks. As a rule the nodules do not exceed 10 cm. in diameter, but a few attain larger dimensions. In the raw condition the mineral is soft, light and nontransparent. The color is white, with occasional blending of yellow, red or gray. The thickness of the meerschaum-bearing strata varies between 3 and 40 m.

Other minerals have been mined or are known to exist in various districts of Asia Minor. Arsenical pyrite has been found near Odemich. Lithographic stone occurs in extensive massive beds north of Mihailich, also east of Kimasti and south of Abulonia Lake. Iron is found in many places in Asiatic Turkey. The region east of Adalia Bay was to have been the site of an exploitation, prior to the war. In the vicinity of Anamur, iron ore has been mined on a small scale during the last few years. This district lies at the foot of the southernmost projection of the base of the Tauric region, where various ores are reported to occur and within which mining has been carried on in a desultory fashion for over 20 centuries. Zinc also exists in this region. Zinc deposits at Karassi were worked prior to the war by the Société Anonyme Ottomane des Mines de Karassi.

Petroleum is found in the provinces of Erzerum, Mosul and Bagdad. The Mesopotamian deposit, probably an extension of the Persian field, promises to be of importance, and the Bagdad railway will give this field much needed transport facilities. Just before the war, the Turkish Petroleum Co. was formed[3] to exploit this area; half of the capital was British and the Deutsche bank and Royal Dutch Shell Trust each held a quarter interest. Further development with this combination of interests is now unlikely. Asphalt is known to exist at Anti Lebanon, Kerkuk, Hit and other places. Besides the mineral resources already mentioned, salt and sulphur are produced in a small way and precious stones are mined in a number of places.

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American Mining Congress

In a letter to the members of the American Mining Congress, J. S. Callbreath, secretary, announces that for the better carrying out of the comprehensive plan outlined at the San Francisco convention to secure the cooperation of the mining men in this country in the betterment of mining conditions, one of the first steps is to secure more interest in the work of the congress. President Carl Scholz, in his plea for extension of membership in the congress, said that there are 90,000 men in the United States directly or indirectly interested in the operative side of mining. Probably there are not 20 men in the 90,000 who disapproved the objects sought by the American Mining Congress. But the organization has only 1,500 members, and this condition presents certain elements of unfairness. It allows the 1,500 members to work for, pay for and secure benefits for the profession in general, while the rest of the 90,000 enjoy them without any effort on their part. President Scholz believes it is the duty of all mining men to work for improvements in the profession and, to secure this end, pleads for an enlarged membership in the congress.

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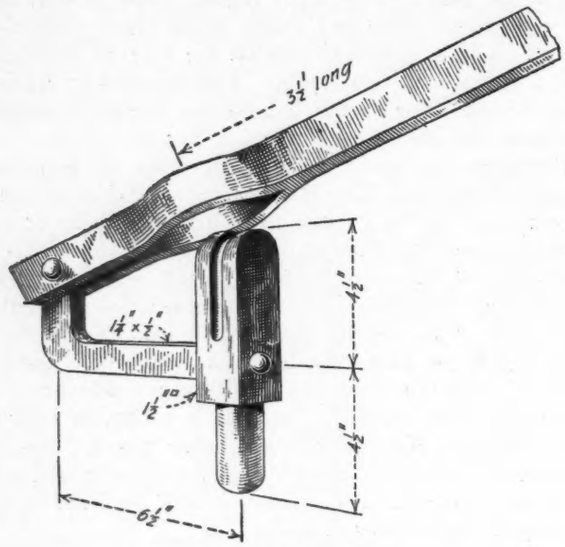
Illium Is the Name for a new acid-resisting alloy worked out at the University of Illinois and described by S. W. Parr at the recent American Institute of Metals convention. Its composition is given as: Cu, 6.42%; Mn, 0.98; Si, 1.04; W, 2.13; Ni, 60.65; Al, 1.09; Fe, 0.76; Cr, 21.07; Mo, 4.67; total, 98.81%; carbon and boron not determined. It is said to be entirely resistant to 25% HNO_3. Its properties are ascribed to a proper proportioning of electropositive and negative metals. Details of preparation are not given.

[3] "Engineering," Oct. 8, 1915.

Details of Practical Mining

Home-Made Chuck-Bolt Bender

The accompanying sketch shows a home-made chuck-bolt bender that will be of great service to any blacksmith in making chuck bolts for piston drills. Without any



CHUCK-BOLT BENDER

device of this kind, it is necessary first to bend the bolt to shape and then to twist the ends apart so that the thread can be cut on each and then reheat the bolt and twist it back again. With this device it is possible to cut it and bend accurately with one downward motion of the lever.

Two Cornishmen and a Jackhamer

By Paul F. Chamberlain*

Thomas Pollard and Robert Bone, two Cornish miners, had a hand-drill contract in one of the drifts of No. 3 Alpena mine, Virginia, Minn. Their "dirt" had been very hard to break all during the month and they were making practically no headway. The two men concluded, along about the 20th of the month, that their contract price was not large enough for them to make a living wage. Accordingly they decided to call on the local superintendent, Charles Grabowsky, and ask him either to give them a better price or grant them company-account wages for the month.

Said Thomas to Robert, "Hi say, pardner, us ain't goin' to make our bloody sault this month. Let me and thee goas on up an' see Cap'n Charlie and see if 'ee won't give us company 'count for the month or else raise the price o' the contract."

It was so agreed; Thomas was to do the talking while his partner stayed outside. Thomas entered the office and doffing his hat said:

*Virginia, Minn.

"Mornin' Cap'n; me and pardner 'ave a drif' contract down in the bal (mine) and we bean't makin' wages, and we thought as how us shouldest come up and talk to 'ee and see if thee couldent fix us up a bit. Say, give we company 'count for the month or raise the price a bit."

"Well now, my man," said the superintendent, "I can not do either at this time of the month, but I am going to send a jackhamer in your place tomorrow which I am sure will help you a whole lot."

"Thank 'ee, Cap'n, that's fair enough sure; we does need a bit of 'elp," said Thomas as he retired. To Robert he reported, "Pardner, we be all fixed up; Cap'n's goin' to send Jack 'ammer into our place to 'elp us out."

"That's fair enough," agreed Robert, "but 'oo the bloody 'ell is Jack 'ammer, never 'eard tell of 'ee. I naw Jack Thomas and Jack Williams, but I never did 'ear of Jack 'ammer; 'oo is 'ee?"

"I dinnaw 'oo 'ee is myself," answered Thomas, "but I speck 'ee's one of they there bloody Finlanders that's been 'angin' about the shaft all week!"

Foundation Bolts for Steel Chimneys*

As the rules suggested by engineers for the sizes of foundation bolts for chimneys vary widely, the following table has been compiled to compare this practice. The

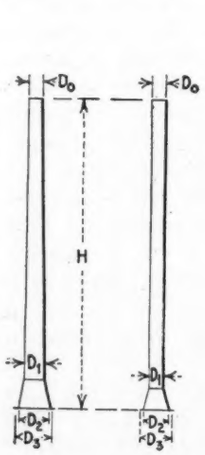


Fig. 1

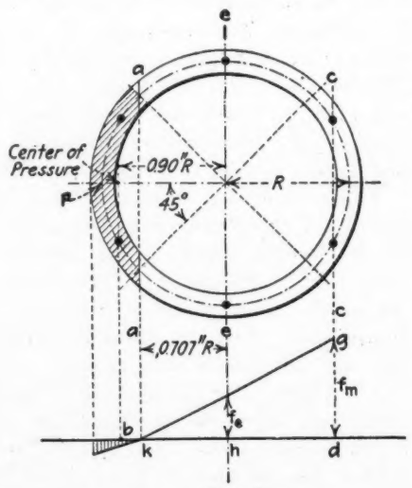


Fig. 2

OUTLINE OF CHIMNEY AND STRESS DIAGRAM FOR FOUNDATION BOLTS

first six chimneys are described in a published pamphlet and are said to have been built. The remainder have been built and are standing. Of the numerous formulas the two extreme ones may be put in the form,

$$fm = \frac{M}{k \times N \times a \times R}$$

in which

*H. D. Hess, professor of machine design, Cornell University, in "Power," Oct. 5, 1915.

M = Moment tending to overturn the chimney, in foot-pounds;

N = Number of foundation bolts;

a = Minimum area of a bolt, usually at the root of the thread;

R = Radius of the bolt circle in feet;

f_m = Maximum fiber-stress in any bolt in pounds per square inch.

The value k varies with the different conditions and is given later.

If we assume the nuts brought to a bearing, with practically no initial stress and no wind acting, the center of pressure between the chimney and the foundation will coincide with the center of the bolt circle. If the wind now acts from the right the center of pressure will move toward the left, and at the extreme position it will approach the point p on the bolt circle. The formula giving the lowest stresses assumes this concentration at the point p and further assumes the fiber-stresses in the bolts proportional to their distances from a tangent through the point p. The value k is then 0.75 in the equation just given, and M is the wind moment less the righting moment. The latter is taken as the weight of the chimney in pounds times R.

In the formula giving the highest stresses the chimney is assumed as fixed at the base, the neutral axis being taken as *e-e*. If the bolts on both sides of *e-e* are effective they must resist compression, a condition here impossible of realization. When the formula is solved in this way k is approximately 0.50 and M is the full wind moment.

DESIGN DATA FOR STEEL CHIMNEYS

Designation	Chimney Diameters: Top D_0 Ft.	In.	Base D_1 Ft.	In.	Bell Base D_2 Ft.	In.	Bolt Circle D_3 Ft.	In.	Ht. of Chimney, H Ft.	Wt. of Steel, Tons	Net Overturning Moment, Ft.-Lb.	Foundation Bolts: No.	Diam. In.	Maximum Fiber-Stress in Lb. per Sq. In.
1	3	4	4	6	7	0	7	6	70	7.1	228,400	6	1¼	11,700
10	4	4	5	6	8	9	9	3	90	12.3	492,100	6	1½	15,200
20	5	10	7	8	12	0	12	6	125	24.7	1,281,270	8	2¼	12,700
30	7	4	9	6	15	9	16	3	175	45.0	3,183,165	10	2¾	17,500
38	9	10	12	0	18	6	19	0	190	62.3	4,706,540	12	2¾	16,600
45	11	10	14	8	25	0	25	6	300	140.7	14,218,000	16	2¾	28,000
B	4	9	..	..	..	..	..	6	5	100	8.3	664,900	4	2¾	20,080
D	6	0	..	..	9	6	9	10¾	125	16.0	1,263,700	4	2	41,400
E	6	6	..	..	9	0	9	4	120	15.3	1,276,400	4	2¾	27,500
F	8	0	..	..	11	3	11	7½	120	.....	1,538,200	4	3	18,400
G	10	0	..	..	14	0	14	6	146	30.8	2,795,460	6	2¾	25,900
K	16	0	..	..	..	..	27	0	225	77.0	10,278,900	12	3	17,600
L	11	6	..	..	..	..	18	0	200	55.0	4,859,000	8	3¼	15,550
M	30	9½	..	..	..	..	51	0	400	438.0	41,518,300	36	4	6,780
R	8	0	12	4	..	..	21	1	217	65.0	4,683,800	12	2¼	11,950

A comparison of the data given in the accompanying table indicates that few of the 15 chimneys had been designed on either basis. It seems to me that a basis nearer the truth might be had by assuming in the extreme position one-quarter of the chimney base in contact with the foundation, as shown in Fig. 2 by the shaded portion. The neutral axis is *a-a*. The bolts to the right of *a-a* are stressed proportionally to their distances from *a-a*. The figure also shows the stresses in the concrete. The moment due to any bolt will be the product of its area, fiber-stress and the arm from the bolt center to a line through the center of pressure and parallel to *a-a*. In this case the value of k is 0.67. The overturning moment is here the wind moment about the base less $W \times 0.9R$. In all cases the wind moment equals the wind force on the chimney times the distance from the base of the chimney to the center of pressure of the wind force. For a cylindrical chimney this equals $\frac{D_1 \times H^2 \times w}{2}$ foot-pounds, where w, the wind pressure per square foot of projected area of the chimney, is usually assumed at 25 to 30 pounds. D_1 and H are measured in feet. The working fiber-stress may be taken from 12,000 to 16,000 lb. per sq.in. The maximum calculated fiber-stresses based on a wind pressure of 30 lb. are given in the right-hand column of the table.

How To Choose Rock Drills

By J. R. McFarland*

Of what type of drill, Mr. Mine Manager, was that last order? Were the drills selected after a careful test which demonstrated them to be of the type best adapted for drilling in your own mine, or were they chosen at random?

With the keen competition nowadays between drill manufacturers and the resultant radical improvement in rock drills as a whole, inasmuch as the drilling cost is a large factor in producing the ore it behooves the active mine manager to make frequent tests to determine on which type of drill to standardize.

Different Classes of Drill Buyers

A considerable number of the older managers and superintendents have used one or two sizes of a standard type of machine for years—usually a one-man and a two-man drill. A large sum of money may be tied up in repair parts. Their machine shops may be making a considerable number of the parts for these drills, thus reducing the cost for repairs. This makes it very hard for a manager to get away from the old type of drill, even though he may be convinced that a newer type is better.

There is also a class that tries everything that comes along and as a result accumulates a motley variety of machines, which causes an extraordinary amount of confusion in and about the mine. A full supply of repair parts has to be kept for each machine, thus involving a much greater amount of money invested in repairs than would be, if only one or two types of machines were used; also, the master mechanic has a much harder time keeping the drills in good repair. Probably the greatest trouble is underground, where the miner may find that the steel does not fit his machine or the hose and connections are not of the right size or have a different thread; or the column, arm or bar and wrenches may be of wrong size. Such trouble causes an extra trip to the surface and maybe the loss of the round for that shift. In losing the round the cost for practically the same advance is doubled. So it is no wonder that some of the older heads feel just as well satisfied to "pass up" the pastime of drill testing.

However, a majority of managers try to keep up with the drill problem, standardizing on one or two of the later types. They figure that the increase in speed and the greater economy in air consumption and repairs more than pay them for the loss in throwing away the old repair parts and designs. In the larger mines and many of the smaller ones the matter of drill testing is gone into with the foregoing facts in mind and with the idea of standardizing on one type of drill for each kind of work.

At a surprising number of mines no systematic attempt is made at testing. The drill is given to the

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runner; the mine foreman or shift boss may stop for a few moments to watch the drill run; the superintendent may hardly notice it as he passes by on his daily rounds; and the manager often never sees the drill at all. In most cases it is left to the runner, and if he likes the machine it is kept. Or if it is a little heavier, even though much faster, than his old one, or if it is one of the newer types which he has not yet learned to run, he will say that the drill is no good and it will be returned.

It is therefore necessary that the trial should be given the best attention and a record kept, or the test may as well not be made at all.

How the Test Should Be Conducted

To go into the problem properly, the following investigation, or one with the same object in view, should be made.

The machine is first taken to the machine shop and placed on the bench. The drill should be taken apart by the master mechanic and a report made on the following items:

1. What points of design?
2. What does the drill promise as to probable repair cost?
3. What air consumption?

The chief points of design are as follows:

a. Are the arrangement and design of the various parts such as to give the least wear or strain?

b. Does the type of chuck enable a rapid change of steel, and does the chuck hold the steel in alignment or not?

c. Are the front head and bushing or gland of proper design and strength to withstand the constant blows of the piston?

d. If a piston drill, is the piston stem of sufficient size and strength to withstand the heavy side strain and does the piston head have sufficient length of bearing to hold the piston in alignment and prevent serious cylinder wear?

e. If a hammer drill with a striking block, or anvil, is the striking block heavy enough?

f. What is the diameter of the cylinder?

g. If a self-rotating hammer drill, how is the rotation transmitted from the piston to the steel? Is rotation positive or not?

h. Is the rifle bar strong enough?

i. Are the ratchet ring and pins or pawls and springs of good design and easily assembled?

j. Is the back head well designed?

k. If a water or hollow-tube machine are the tube and packing so designed as to give little trouble and be easily accessible?

l. The valve chest is very important. Does it freeze or not? Does it use air wastefully? Is it in the way when extracting steels from the holes?

m. If a stoper, is the feed piston of proper size for your air pressure? Is it of sufficient strength to withstand hard blows?

n. Is there any special benefit from the arrangement of the side rods, springs, throttle valve, oiling device, hose connections, shell, etc., of the machine in question?

o. What is the weight of the machine?

p. Finally, are the parts that are subject to the greatest wear and strain made of properly treated and worked steel or are they made of cast iron?

The master mechanic is able to tell to a great extent, from the foregoing investigation, whether many parts will be broken and whether such parts as are ordinarily expected to break in time will cost much to replace. If the company maintains an elaborate machine shop, the master mechanic may figure on the number of parts he may be able to make himself. An accurate record of repair costs should be kept to determine whether the superior speed of one drill is not more than counterbalanced by the low repair cost of another.

As a rule, only a few mines have any apparatus to test the air consumption. Machines for testing may be purchased from various drill and machinery companies.

The displacement-tank method, while rather cumbersome and expensive, is always reliable. In this, water under pressure is used to displace the air from two receivers alternately. The drill is run from the air thus expelled. The quantity of air consumed by the drill is figured from the amount of water that displaces it. The amount of water is indicated by the height in the water gages on the two receivers. Air meters are constructed on the principle of the fan or bellows or a combination of both. They are not usually so reliable as the displacement-tank method, but are less cumbersome. However, if two drills are tested at the same pressure, a reliable comparison can be obtained.

An inexpensive way to obtain a comparative test of two machines is to fill a receiver with air to a certain pressure and run each machine in turn from the receiver, noting the time necessary to reduce to various pressures. It is obvious that the drill that reduces the pressure to the lowest point in a given length of time uses the most air. However, owing to the different valve designs, some drills use proportionately more air at some pressures than at others, and this fact has to be kept in mind in such a test.

A very few mines have an elaborate system of testing the strength, nature and rapidity of the blow of a machine. This test is not essential, although it is well to know, if possible, just how the drill in question compares with others in this respect. This test is valuable in testing drills after they have been in use for some time. An exhaustive consumption of air generally shows that the piston or cylinder or both are badly worn. If the air consumption is no more than proper but the blow is weak, it is likely that the trouble is in the valve or valve ports. If the valve "flutters," it is generally a sign of excessive cylinder wear, as the air is allowed to pass by the piston and into the reverse ports, thus reversing the stroke prematurely.

As a general thing, a light, rapid, tapping blow is best adapted for soft ground, while a heavy, slugging blow is best for harder rock. However, it is difficult to tell from this kind of a test just what drill is going to do best in your ground and the only sure way to find it out is by the actual drilling.

Making the Underground Test

Having made the tests above ground, the next thing is to prepare for the underground test.

A suitable face to drill in must be selected. This is a point where mistakes are sometimes made. There is a tendency on the part of the superintendent to pick the hardest rock in the mine. This should not be done unless the sole object is to test the strength of the drill.

The rock chosen should be a fair average of what is encountered in the mine. A drill specially designed for hard rock would make the better showing if tested in the hardest rock in the mine; while another drill, adapted to the average mine rock, would not do so well in the hard rock, but would do much better than the other in the average rock that has to be drilled.

Drill Type Must Fit Conditions

In this connection it may be said that it does not usually matter so much what make of drill you buy, as that the drill should be selected for the special conditions in your mine.

In a great many mines, most of the attention is given to the studying of the ore formation and little toward cutting down the production costs. It is in such mines that contractors thrive, as they are able to give their whole attention to progress.

In such mines, where no special effort is expended toward drilling efficiency, or in portions of mines that are working in ore, or where water is hard to obtain, it may be best to use the one- or two-man solid-piston machines, depending on the hardness of the ground. This is particularly so in stopes and sublevels, where the machines have to be taken up and down chutes or ladderways and where it would be too much bother to take water and the extra fittings for the water drills. If possible it is best to use self-rotating hammer drills for drifting in such places. This method of drilling often doubles the speed on account of the fact that no mounting need be used. It is desirable to use the hammer drill with water through the steel. If air is used through the steel, a spray or atomizer should be attached to lay the dust as it is blown from the hole.

If much attention is given to speed, a water drill should be used if possible. Such a drill is best adapted to the driving of long drifts in development work. If the ground is soft or if the rock is "ravelly," with much fine rock falling in behind the bit, it is often best to use a water-piston machine. The action of the alternating water and air jet, together with the reciprocating motion of the steel, always leaves the steel free to be pulled from the bottom of the hole. If the water-hammer drill be used in such ground more time is often required to extract the steel than to drill the hole. If in hard, solid rock, the water-hammer drill will probably give as great or greater speed than the water-piston machine.

For sinking work either the heavy two-man solid-piston drill or hollow-piston two-man machine can be used. The latest and most popular method of shaft sinking is with the self-rotating hammer drill. With this machine the round can be drilled in less time as no mounting is used. The holes also can be spaced better and drilled at more advantageous angles, thus "pulling" the ground better.

After a suitable place is selected, proper steel should be prepared. The bits should be well formed and tempered for the rock selected and the shanks made the right size. Proper mounting, wrenches, hose and connections must be provided. A pressure gage should be placed at the end of the air-pipe line if one drill is tested at a time.

In testing, one man should be detailed to keep an accurate record of all operations, taking readings of the air pressure every 10 minutes or so, if much variance is had, or every half-hour if the pressure is fairly constant. If a comparison is to be made with another drill, care should be taken to have all conditions as nearly alike as possible. The test should be conducted by the same person and the same drill runners, using the same gage of steel and as close as possible to the same average air pressure. The following report should be made, the example including actual test figures.

1. Type of machine: Sullivan FF-12 Water Drill, size 2⅝ in., weight 162 lb.
2. Place of work: American Flag Mine, Park City, Utah., north heading, 900-ft. level.
3. Date: July 30, 1913.
4. Kind of ground: easy-drilling quartzite.
5. Character of work: drifting; size of drift, 5x7 ft.
6. Type of mounting, column and arm.
7. Average depth of hole, 6 ft.
8. Gage of steels: Starter, 2½-in.; dropped ¼ in. gage on each change of steel.
9. Air pressure at drill, 80 lb.
10. Time of starting work, 7:30 a.m.
11. Time of stopping work, 4 p.m.
12. Total elapsed working time, 7 hr. 30 min.
13. Exceptional delays, none.
14. Total elapsed drilling time, 5 hr., 30 min.
15. Total net elapsed drilling time, 2 hr. 30 min.
16. Actual net reciprocating time, 1 hr. 30 min.
17. Number of holes, 9.
18. Total footage, 54 ft.
19. Drill speed, average inches per minute: (a) Total elapsed drilling time, speed 2 in. per min.; (b) net elapsed drilling time, 4.3 in. per min.; (c) actual drilling time, 7.2 in. per min.
20. Number sticks of dynamite, 27; strength, 40%.
21. Results: (a) Advance, 5½ ft.; (b) cars of muck removed, 20.
22. Name of runner, John Doe.
23. Name of official in charge of test, John Smith.

Remarks on the Form for Reporting Test

1. The type and size of machine should be stated as a matter of record. The weight must be suited to the work and hardness of the rock.

2 and 3. The location and date are a matter of record.

4. In giving the report it is essential to show the class of rock and hardness in order to make any just comparison. A drill that drills 7 in. per min., actual drilling time, in medium-soft rock, may not drill 1 in. per min. in very hard rock.

5. The character of the work is a matter of record and must be stated before the operations can be completely understood. The size of the tunnel, shaft or stope should be given for the same reason.

6. It is well worth while to show the type of mounting used, as considerable time may be gained or lost from this cause. If a piston drill is used in a stope with a column mounting, it is quite possible that a hammer drill may be substituted and save an hour or two of time by the omission of setting up, tearing down of the column and the time lost in changing positions on the column.

If only one shift drills and the next shift mucks out, it is best to use a vertical column, as a "clean" set-up is afforded when the drill shift goes on. The column permits vertical as well as horizontal shifting of the drill and gives the runner a better chance on a "running" hole. However, if drilling is to be done on the same

shift as the mucking, it is often advisable to use a horizontal bar. While drilling is harder and a better runner is required to "bottom" his holes, yet the bar can be set up at once; but if the vertical column is used, an hour may be spent in "mucking back" to clear a place to set the column.

Sometimes, when the ground is favorable, all the holes can be drilled from one set-up. Even though the bar has to be lowered for the bottom holes, only a few minutes is required, as compared with a possible hour lost in "mucking back."

As the "mucking back" is only a waste of high-priced driller's time and the work is a total waste, the muck having yet to be shoveled into the car, the use of a bar wherever possible cannot be too strongly emphasized.

Slick Sheets Should Be Used in Shoveling

It is also surprising how few mines use boards or "slick sheets" for the muck to be shoveled from. A few minutes spent each shift in handling the "slick sheets" will save the mucker an amazing amount of time and energy. Rapid mucking also helps the drilling, as the muck is cleared away from the bottom of the face by the time the runner reaches his lifters and he is not forced to wait or take the valuable time at the end of the shift to scrape the muck back.

The length of the shell depends on the hardness of the ground. If it is very hard, the holes have to be inclined at steep angles in order to break the ground. To drill thus, the shell must be short so that the roof will not interfere with the crank handle. Also, in hard ground, with a long feed the gage may wear off the steels to such an extent that they will not "follow." If the rock is soft, a long feed is desirable and time is saved in changing steels.

7. In even rock the cuts and lifters should be drilled somewhat deeper than the other holes, to maintain an even face, as they are drilled at a greater angle and do not penetrate as far directly into the "face" as the "flatter" holes.

8. The gage of the bit is important. The smaller the bit, the faster will the rock be drilled. However, the hole must be large enough at the bottom to take the powder and hold enough at the bottom of the hole to break the rock. If another drill is to be compared, it is quite important to test with the same gage of bit.

It is quite obvious that attention should be given the bits and that they should not only be tempered for the rock to be drilled, but should be well formed so as not to retard the speed of drilling. If the rock is so hard that trouble is experienced in making the steels follow, give a greater difference in the changes of gage.

The breakage of drill steel should be noted. Little trouble is had with piston-drill steel breaking, but some types of hammer drills, because of the heavy blow delivered direct to the steel by the piston, cause crystallization and excessive breakage.

9. The air pressure in some mines may vary at some places and on some days 20 or 30 lb. This may be caused by a pipe line of too small diameter. When several machines are running close by or someone is "blowing off," the pressure drops abruptly. For this reason it is desirable to have sufficient air pressure in order to make a fair comparison, and absolutely necessary to have a correct record of the average air pressure.

In this connection it is surprising how little some superintendents know about the air pressure on which their drills are running. Many drills that are generally supposed to be running on 75 to 80 lb. of air are running on only 50 to 60 lb.

If two drills are tested at the same time on the same bar or on columns in the same tunnel or drift, the air gage is not so essential, as both the machines have the same air pressure. However, the pressure should be kept up to normal for the reason that one drill may give a much better performance on a low air pressure than another. Owing to this fact, the pressure should be close to that which is customary in the mine, so that the test may parallel mine conditions.

10 and 11. The time of starting and stopping work is a matter of record. In this case while the full shift was 8 hr., the time given was only 7 hr. 30 min., as this was the time actually at the face. Usually a good deal of time is "killed" around the beginning and end of a shift. In the larger mines a considerable length of time is consumed in getting the steel together and reaching the working place. Then if the work is day labor and the boss is not around, a nice long rest and a smoke are in order.

At the end of the shift the men have to be ready by the time the men in the next place to them "fire" or they have to leave the round unfinished. For this reason the runner always tries to get his place ready to shoot 15 min. or more before the usual shooting time.

12, 13 and 14. The difference between the total elapsed working time and the total elapsed drilling time (from the start of the first hole to the bottom of the last) was in this case 2 hr. About one hour was used in mucking back for the column and setting up. The other hour at the end of the shift was used to tear down the column, take the machine and equipment back to a safe distance and load and shoot the holes. The time consumed in setting up was afterward cut down from 1 hr. to 15 min. by the substitution of a crossbar.

No Nuisance Worse Than Drills Freezing

In order that the test should show up the drill fairly, any unusual delays should be recorded. In a mine, time can be lost in a multitude of ways. The steel may not have been tempered correctly and the drills may all be dulled before finishing the round. Where miners have to "rustle" their own steel, it is hard to get them to provide enough. Where the ground is soft, it is often hard to keep the bar or column tight. Hose troubles can be avoided to a great extent by running the hose on boards over the heads of the muckers. But none of the foregoing troubles can compare to the freezing of a drill. In quite a large number of mines there are too few receivers to catch the water and too little attention is given toward draining off the water from the receivers. It is left to the foreman, and as he is little bothered with freezing in his climbing up and down ladderways, the matter is neglected.

It has also been found that in wet mines, when the air is off between shifts, considerable water leaks in the submerged pipes. On a wet day outside, the freezing of the drills is more noticeable, as an unusual amount of moisture is taken into the compress. The freezing not only delays the drilling, often causing the loss of the round, but also causes the piston frequently to

kick the back head out. While numerous suggestions have been made to keep the valves from freezing in rock drills, usually none of them is of much effect. As some types of valves have less tendency to freeze, or are entirely free from freezing, it is best to use such types where much water is found in the air.

15 and 16. The difference between the net elapsed drilling time, (from collars to bottoms of holes) and the actual net drilling time (time machine is in actual operation) shows how much time is taken up by changing steels and position, if we leave exceptional delays out of our consideration. In the case cited, the difference was one hour.

How Long Do the Drills Work?

It surprises some people to know the small amount of time the drill is actually running. In this case it was 1 hr. 30 min., or less than 30% of the total time between the beginning of drilling and the end of the round. As this is unusually fast drilling for mine work, 30% is unusually low. The softer the rock and faster the actual drilling, the lower will be the percentage. And in harder ground more time will be taken up in actual drilling and the percentage may rise to 60% or higher.

17. The number of holes and their depth depend entirely upon the ground. The harder the rock, the greater the number of holes to break it and the shallower they are drilled.

18. By adding the depth of each hole the footage is obtained. The footage drilled is, roughly, a measure of the speed of the drill, and if no complete record is made this measurement should be taken.

19. The average rates of drilling, in inches per minute, tell the experienced superintendent most of what he wants to know, before looking at the rest of the test. Of these averages the actual drilling time is the most important.

20. The strength of the dynamite and the number of sticks are an indication of the hardness of the ground.

21. The final results of the whole test, which every mine manager wants to see, are the number of feet of advance and the number of cars of ore broken. Knowing this, he is able to figure his drilling cost per ton, per cubic yard or per foot of advance. If in development work, the advance is the main object and the one on which the manager figures his expenses; if in ore, the number of tons of ore broken by the shot is where the profit lies. If two tests are run in the same-sized drifts in rock of the same hardness, these figures are easily obtained and constitute an approximate but final test of the speed of the machines.

22 and 23. The names of the runner and official in charge of the test are a matter of record.

In a test of two drills at the same time, it is best to change the drillmen from one machine to the other so as to equalize their skill. If the machines run pretty close together in speed, the change may be made in the middle of the shift. If, however, one machine does considerably better than the other, the changes should be made more frequently, as there is a tendency for the drill runner who is ahead to favor that drill; and if, when the change is made, the other drill is much behind, he will most likely slow up and not try. However, if a fairly equal progress is made, the drill runners will give an unusual exhibition of energy, for it is human nature for each one to think that he is just a little better than the next one. Such a test should be conducted on the same basis as the previous one with the exception of items 20 and 21, which may be omitted, as they have no bearing in this case.

Methods Used in Testing Stoping Drills

If one stoping drill is to be tested, the method is the same as that of one rock drill. In testing two stopers against each other, the simplest and possibly the most efficient method is to place the two drills side by side, along the side wall of a heading. The positions of the holes to be drilled are marked off with a piece of chalk. One hole should be inclined as close to the horizontal as the cuttings will fall out, and about three more holes drilled at various inclinations up to the vertical. Several series of these holes should be marked.

After plenty of steel has been obtained and the runners have made sure that they will "follow" and that there will be no delay, the drills are started on the same corresponding holes and run continuously for a half-hour, over-all time, changing the drill runners frequently from drill to drill. The holes should all be drilled to approximately the same depth, unless a steel should become seriously stuck. At the end of the time, the holes are measured and it is pretty safe to assume that the drill that has drilled to the greatest depth is the fastest machine and best adapted to the ground.

Drilling Thirty Feet in Thirty Minutes

A case came under my observation at the Veteran Shaft of the Nevada Consolidated Copper Co., near Ely, Nev., where one stoper, when tested as to actual drilling speed, drilled 35% faster than the other. When placed side by side and the foregoing test run, the first stoper drilled 20 ft. in a half-hour and the apparently slower one of the two, when judged from the first test, drilled 30 ft. in the same time. This change in comparison was caused by the fact that the feed cylinder on the first machine was too large, which, although it caused the machine to drill faster, at the same time caused it to "bury" the bit in the softer ground, and in the "flatter" holes the machine drilled so fast that the cutting did not fall out fast enough and again caused the bit to stick. While the first drill would probably have been the faster one in a little harder rock, this test proved conclusively which was better adapted to drilling in the ground in question.

In this connection, I wish to say that this was the fastest drilling I ever saw. The average of a foot a minute for a half-hour, over-all time, was the result of the extraordinary pace set by the runners; the fact that the steels were handed to them and the time elapsed for changing each steel probably did not exceed a few seconds. The rock was soft, dry porphyry and unusually easy drilling.

In conclusion, the mine manager must have the following information in order to know absolutely which drill is the most efficient for his mine: First, he must have the report from the master mechanic on repair cost and air consumption; next, he must have the results of the underground tests on drill speed and work accomplished; finally, with this information before him, he must figure out the drilling cost per ton or per cubic yard of rock removed or per foot of advance.

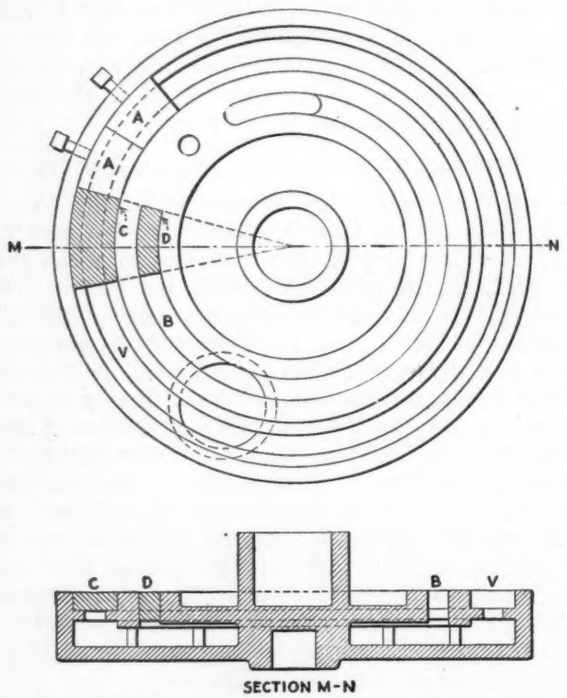
Details of Milling and Smelting

Raising Drum-Filter Vacuum

By Herbert G. Thomson*

It is sometimes necessary to run filters of the rotary-drum type with a low pulp level in the tank on rapidly settling slimes. A reduction of vacuum will result, owing to air passing through the canvas on the two or three exposed sections of the drum between the blowoff and the pulp level. The following simple method of increasing the vacuum was used at the Globe Consolidated mill, Dedrick, Calif.

A wooden block *C* was carefully fitted into the annular vacuum slot *V* in the exterior section of the head valve, of sufficient length to cover entrance holes of pipes leading to the two exposed sections of the drum. Since the



METHOD OF BLOCKING THE VALVE PORTS

blow and vacuum slots are connected below the blowoff point, it was necessary to insert a similar but shorter wooden plug *D* in the blow slot *B* covering the two corresponding pressure-pipe holes. The faces of the two blocks were flush with the face of the valve. Upon being moistened with solution the wood expanded and fitted tightly, effectually shutting off the vacuum from the exposed sections. As a result the vacuum was raised nearly three inches, with the result that the cake was held more securely on the drum and filtration was carried through more rapidly.

A glance at the accompanying sketch will show that the changes made were, in effect, merely the lengthening of the two steel blocks *AA* inserted in all machines by the manufacturer. When run normally, with the tank nearly full of pulp, these are of ample length to prevent loss of vacuum.

*Globe Consolidated Mill, Dedrick, Calif.

Concentration Formulas

By J. E. Clennell*

In certain cases some ambiguity occurs in the interpretation of the results of small-scale concentration tests, owing to the presence of factors that would be eliminated in practice. In a small test it is usually impossible to obtain a close concentration of the valuable mineral in one product, and produce clean tailings in a single operation. Usually a considerable amount of middlings is produced, which must be worked over repeatedly to obtain the desired result. This applies both to gravity concentration and to flotation.

By making certain assumptions, however, we may calculate the effect of this repeated concentration without actually performing the operation. In practice, the middlings, if produced at all, are continuously returned to the head of the machine, and it may, in general, be assumed that the assay value of the clean concentrates and tailings produced is not affected by this procedure. This assumption, which is the basis of the following formula, appears to be legitimate—at least in cases where the heavy or floatable mineral is substantially of one kind, so that the middlings are not of a different nature from the ore itself, but consist merely of a mixture of the same constituents found separately in the concentrates and tailings.

Let C, M and T respectively represent the percentage weights of concentrates, middlings and tailings obtained in the actual test; X and Y, the required percentage weights of concentrates and tailings that would be obtained if middlings were eliminated; h, c, m and t, the assay value (in any unit) of heads, concentrates, middlings and tailings respectively; x and y, the required percentage of total value in concentrates and tailings respectively, when middlings are eliminated. Then since

$$C + M + T = X + Y = 100$$

and

$$Cc + Mm + Tt = Xc + Yt$$

it follows that

$$X = \frac{Cc + Mm - (100 - T)\,t}{c - t} \qquad (1)$$

and

$$Y = \frac{(100 - C)\,c - Mm - Tt}{c - t} \qquad (2)$$

also, since

$$x : 100 :: Xc : 100\,h$$

and

$$y : 100 :: Yt : 100\,h$$

$$x = \frac{Xc}{h} \qquad (3) \qquad \text{and} \qquad y = \frac{Yt}{h} \qquad (4)$$

*Metallurgical chemist, Butters Patent Vacuum Filter Co., Oakland, Calif.

As an example of the application of these formulas we may take the following figures from an actual concentration test. The head assay showed gold, 0.895 oz. per ton.

DATA OF CONCENTRATION TEST

Product	Weight, %	Assay of Product, per Ton, Gold, Oz.	Per Cent. of Total Gold
Concentrates	12.45	6.53	90.8
Middlings	11.45	0.35	4.5
Tailings	76.10	0.055	4.7

It is desired to find the effect of eliminating the middlings in this statement.

Here $C = 12.45$, $M = 11.45$, $T = 76.1$, $h = 0.895$, $c = 6.53$, $m = 0.35$, $t = 0.055$.

From (1)

$$X = \frac{(12.45 \times 6.53) + (11.45 \times 0.35) - (100 - 76.1) \times 0.055}{6.53 - 0.055}$$

$$= \frac{83.9915}{6.475} = 12.97$$

From (2)

$$Y = \frac{(100 - 12.45) \times 6.53 - (11.45 \times 0.35) - (76.1 \times 0.055)}{6.53 - 0.055}$$

$$= \frac{563.5085}{6.475} = 87.03$$

From (3)

$$x = \frac{12.97 \times 6.53}{0.895} = 94.63$$

From (4)

$$y = \frac{87.03 \times 0.055}{0.895} = 5.35$$

The result of the test then appears as follows:

DATA ON CALCULATED CONCENTRATION TEST

Product	Weight, %	Assay of Product per Ton, Gold, Oz.	Per Cent. of Total Gold
Concentrates	12.97	6.53	94.63
Tailings	87.03	0.055	5.35
			99.98

Michaud & Delasson's Process of Tin Refining

A process for refining tin electrolytically has been patented by Georges Michaud and Eugene Delasson of Montreuil, France (U. S. Pat. 1,124,315). The electrolyte consists of $SnCl_2$, 100 parts; H_2SO_4, 10 parts; $MgCl_2$, 1 part; and boric acid, 1 part, made up in a solution of 20° Bé. The cathode is to have a surface equal to 2% of that of the anode, and the tin is deposited in noncoherent form and later scraped off the cathode which is preferably of copper. The solution is continuously regenerated by circulation through a tank containing tin waste of any sort whatever.

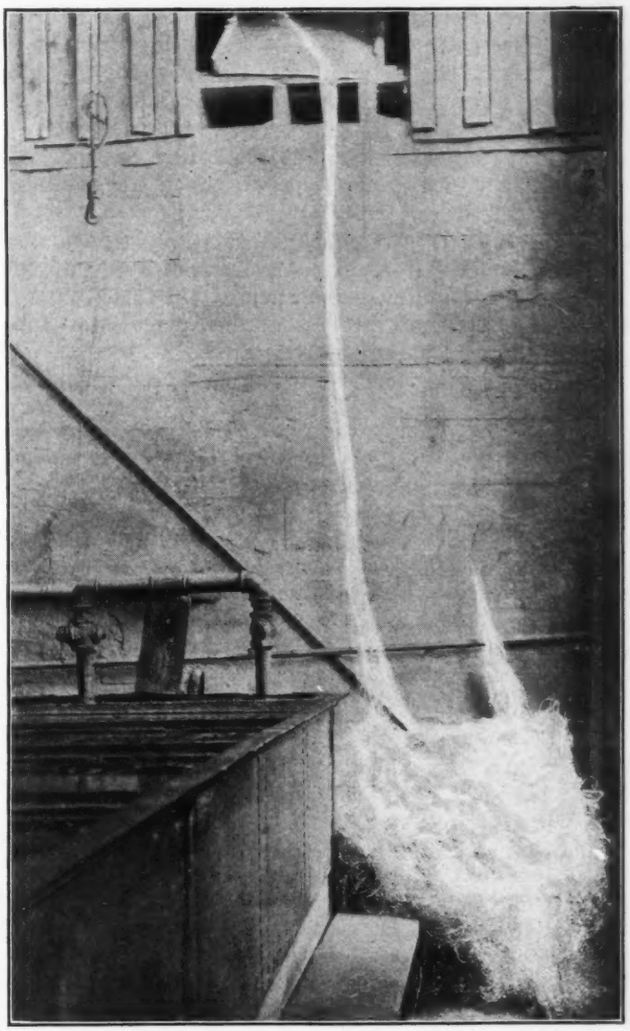
Sulphur Dioxide Recovery, Garner Process

Sulphur dioxide may be recovered from gases comparatively poor in it, according to James B. Garner, of Pittsburgh, Penn., assignor to the Metals Research Co., of New York (U. S. Pat. 1,145,579), by passing the gases at room temperature, say 11 to 24° C., over charcoal, when the SO_2 is absorbed, and later heating the charcoal to from 130° to 180° C., when the SO_2 is expelled. The enriched gas, which, the author says, may occasionally carry even 98 to 99% of SO_2, is recovered and used. He also calls particular attention to the fact that various charcoals have different affinities for sulphur dioxide, and particularly recommends the use of boxwood.

System of Zinc-Shaving Disposal

By Jesse Simmons*

At the Wasp No. 2 mill, Flatiron, S. D., the shavings cut on the zinc lathe for use in the precipitation boxes are conveyed in a short chute through a partition and thence drop to the floor of the precipitation room. The accompanying illustration shows the shavings coming through the chute and piling up on the floor.



SYSTEM OF HANDLING FRESH ZINC SHAVINGS

This, or a similar method, is essential to quick production of the material. To allow the shavings to drop into small boxes on the floor behind the lathe necessitates frequent changes of the boxes and stoppage of the lathe. This scheme gives plenty of room for an entire roll of zinc, cut into shavings, to pile up out of the way. It requires practically no attention on the part of the lathe man.

*Deadwood, S. Dak.

The Assayer and Chemist

The Ignition of Magnesium Pyrophosphate

In making determinations of phosphorus or magnesium, it has been found difficult to ignite the magnesium pyrophosphate to complete whiteness, even with greatest care, when the usual methods are followed, says S. H. Champlin in the *Chemist-Analyst,* July, 1915. The operation may be carried out quickly and easily as follows: Place the wet filter and precipitate in a Vitreosil crucible and dry over a low flame, inclining the crucible on the triangle and resting a cover against the top so as to cause the warm gases to circulate over the paper. When the paper begins to brown, place the crucible, uncovered, in a muffle below a red heat and smoke off the paper. Cool, and saturate with nitric acid (sp.gr. 1.42). Warm gently to expel the excess of acid, increasing the heat slightly until red fumes come off. Return to the muffle, now at a dull-red heat, and ignite until the evolution of red fumes ceases. Then raise the temperature to a bright-red heat and ignite until constant weight is obtained.

The use of a platinum crucible has never been attempted on account of the danger of alloying.

Assaying Samples Containing Coarse Gold

In a discussion of the influence of coarse gold particles on assaying, before the Institution of Mining and Metallurgy, W. H. Goodchild (*Bull.* 104) suggests that for spotty ores containing large particles of gold the best method is often to reduce 10 lb. to 40-mesh and pan the entire amount. The pannings should next be assayed separately as "metallics" and the tailings dried, cut down, ground and assayed in the usual manner. The final assay is then computed from the tailings and metallics assays.

This is very reminiscent of the method adopted by Sidney Jennings in his valuation of the Alaska Ebner mines, where 30-ton samples were put over concentrating tables and about 1½% concentrated out, carrying the free gold, pyrite, galena, etc. The concentrates were then treated in an amalgamating barrel. The tailings from the Wilfleys and from the barrel were easily sampled and the final assay was then calculated from the barrel recovery, the barrel tailings and the table tailings. In this way concordant results could be obtained.

Exact Determination of Sulphur Dioxide in Air

By J. R. Marston*

In the spring of 1910 it was necessary to devise a method for accurately determining minute quantities of sulphur dioxide in the air in the vicinity of the Selby Smelting and Lead Co.'s Plant, at Selby, Calif. A method was worked out and satisfactory results were obtained. Later, in May, 1913, the Selby Smelter Commission was appointed and a large amount of work was done in checking up the method, under the direction of A. E. Wells, chief chemist for the commission. All possible sources of error were investigated and different methods of manipulation studied, the degree of accuracy and technique being improved, so that the sensitiveness is one part in ten million. The method finally adopted by the commission is as follows:

Preparation of Apparatus

Take two clean glass aspirators of about 25-liter capacity, having one tubulure at the top and a second at the side near the bottom. The upper tubulures are closed with single-bore rubber stoppers carrying glass stopcocks and the lower tubulures with single-bore rubber stoppers fitted with glass plugs.

To make a determination, mix 100 c.c. of starch solution with 400 c.c. of distilled water, add 3 grams of KI and sufficient $N/500$ iodine solution to produce a good lavender tint. Divide this solution between two wide-mouth bottles of about 500-c.c. capacity each, fitted with three-hole rubber stoppers. (These will be referred to as titration bottles.) One hole carries a tube extending to the bottom of the bottle, the second carries an L-tube extending just within the stopper and the third hole is open. Insert the L-tube of each titration bottle in the rubber stopper at the side of the corresponding aspirator, close the third hole of the titration bottle with a finger and allow the starch solution to run into the aspirators. Detach the titration bottles, close the hole in the aspirator stoppers and shake the aspirators vigorously for about a minute. Return the starch solution from each aspirator to its titration bottle and compare the colors. The shade should be identical; but if not, pour the two portions together, mix, divide the solution and repeat the foregoing operation until the colors do match.

For an actual determination, the two 250-c.c. portions of colored starch solution are run into the respective aspirators. One aspirator is evacuated to a pressure determined by a mercury manometer, the stopcock at the top is opened and the sample of air to be tested drawn in. Shake the aspirators for one or two minutes and return the starch solutions to the titration bottles for comparison. $N/500$ iodine solution is added to the solution from the test aspirator until its color exactly matches that of the solution from the control aspirator. The iodine solution is drawn from a burette fitted with a narrow tip, which is passed through the third hole of the titration-bottle stopper, thus avoiding exposure of the solution to the air. If the starch solution from the test aspirator has been completely decolorized, both solutions are returned to their respective aspirators (after the addition of the iodine solution), the aspirators shaken for one minute and the comparison repeated as previously cited. This

*Chief chemist, Selby Smelting and Lead Co., Selby, Calif.

procedure is continued until the colors of the two solutions exactly correspond.

When 1 c.c. of $N/500$ iodine solution is equivalent to 0.0224 c.c. SO_2 at standard conditions, this factor multiplied by the number of cubic centimeters of $N/500$ iodine solution required to bring the solution from the test aspirator to the same color as that of the control aspirator gives the volume of SO_2 at standard conditions.

$$\frac{\textit{Vol. asp. in c.c.} \times 273 \times \textit{man. reading in mm.}}{\textit{Abs. temp. of the air in asp.} \times 760} =$$

volume air, standard conditions.

$$\frac{\textit{Vol. } SO_2 \textit{ at st. cond.}}{\textit{Vol. air at st. cond.}} \times 1{,}000{,}000 =$$

parts per million of SO_2.

Example:

Volume of aspirator	24,000 c.c.
Manometer reading	380 mm. Hg.
Temperature of air in aspirator	20° C.
N/500 iodine solution used	1.2 c.c.

$1.2 \times 0.0224 = 0.027$ *c.c.* SO_2 *at standard conditions.*

$$\frac{24{,}000 \times 273 \times 380}{(273 + 20)\ 760} = 11{,}200$$ *c.c. air at standard conditions.*

$$\frac{0.027}{11{,}200} \times 1{,}000{,}000 = 2.5$$ *parts per million* SO_2.

To prepare the iodine solution, weigh out 1.27 grams of pure iodine and 5 grams of KI and make to 1 liter. Dilute 200 c.c. of this solution to 1 liter, which gives an $N/500$ iodine solution. The starch solution contains 2 grams per liter.

The control bottle is used to check a volume of air free from SO_2 against an equal volume of air which may contain SO_2. It compensates for the iodine consumed by substances contained in the water, etc. KI is added to the starch solution to increase the sensitiveness of the reaction. The lavender end-point is more sensitive than the blue.

It is impractical to evacuate a 24-liter bottle below one-half an atmosphere, as it is liable to collapse.

The two-minute shaking gives ample time for the SO_2 to react with the iodine. The two portions of starch solution are mixed at the end of each test, then divided, when the solutions are in readiness for the next test.

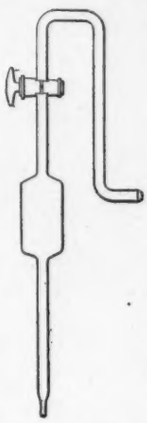
Determining Lead as Sulphite

An investigation of the suitability of lead sulphite for the gravimetric determination of lead is described by George S. Jamieson, *Am. Journ. Sci.*, p. 157, 1915. Lead may be precipitated quantitatively from a slightly acid solution by sodium or ammonium bisulphite, or even by aqueous sulphurous acid, if the acidity of the solution be carefully controlled. When a solution contains much acid it should be almost neutralized with ammonium hydroxide before attempting to precipitate the lead.

A 2% solution of bisulphite should be added in excess to the lead solution, the solution thoroughly stirred and allowed to settle for an hour or longer. The precipitate is then filtered on a Gooch and thoroughly washed with cold water. The liquid should not be allowed entirely to pass out of the Gooch until the washing is complete. This is very important. The lead sulphite is then dried at 150° C. for an hour and weighed as $PbSO_3$. Alkaline-earth metals interfere, being precipitated with the lead.

A Modified Pipette

The accompanying sketch shows a form of pipette which has been found very useful by Sidney Born (*Journ. Ind. Eng. Chem.*, July, 1915) in his laboratory. It is made by fusing a stopcock and a piece of bent glass tubing to a pipette. The advantages over the ordinary pipette are:



MODIFIED PIPETTE

1. Safety—There is no danger of sucking up acid or dangerous liquids.
2. Ease of Manipulation—The stopcock insures tighter closing and greater accuracy than use of a finger.
3. Accuracy—The line of demarcation is level with eye when using.
4. The pipette can be carried around full without losing any liquid.

Macroscopic Etching of Steel*

The microscopic examination of steel by polishing the surface of small samples and etching with reagents has been brought to a far higher degree of excellence than has the technique of rendering visible on a large scale porosity, lack of homogeneity in composition, and other defects in steel that rolling or forging has rendered difficult to detect by ordinary optical inspection. Any improvement in the macroscopic methods would be very desirable, and such an improvement seems to have been found in etching the steel with molten zinc.

In samples described in this paper bars 10 in. by 1¼ in. by $\frac{5}{16}$ in. of openhearth iron, Norway iron, and openhearth steel, were suspended in the molten zinc of a 14-ft. galvanizing pump by means of iron wires. Later, some more samples of carbon tool steel and high-speed steel were added. On taking the samples from the molten zinc the mass of dross surrounding them could be broken off while still hot by blows from a hammer, and the coating of metallic zinc removed by immersion in dilute sulphuric acid, which does not affect the steel or iron so long as any zinc remains. High-carbon areas are rapidly eaten away by the molten zinc, and the method seems to afford a useful means of detecting such spots and, in general, lack of homogeneity in the surface. A few unsatisfactory trials have been made of etching nickel steel in molten tin, while the use of metallic mercury as an etching fluid and the extension of this method of testing to nonferrous metals are under consideration.

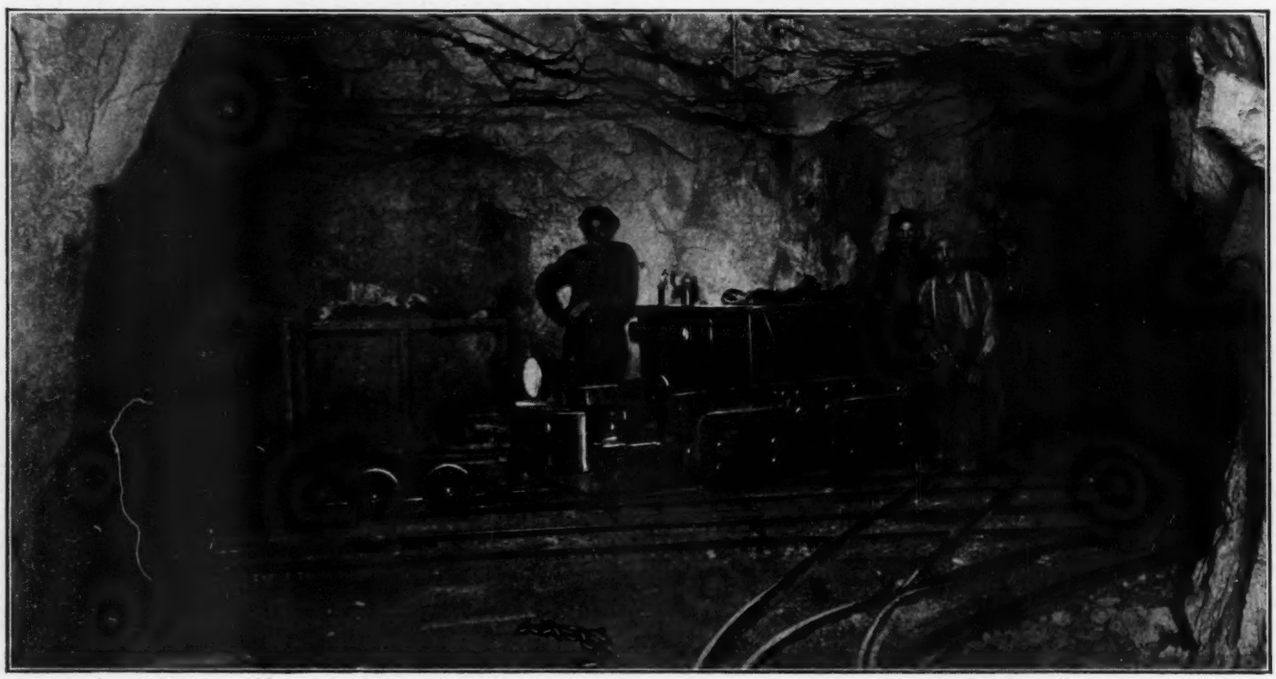
For Cleaning Laboratory Glassware, F. C. Mathers, writing in the "Chemist-Analyst," recommends a mixture of sulphuric and nitric acids, used at a temperature just too low to distil off HNO_3 or SO_3. Thick glassware should be placed in a cold solution and gradually heated. Enough nitric acid should be added to keep the mixture white or yellow in color. The combination is said to be superior to the bichromate-sulphuric acid mixture ordinarily used.

*Abstract of a paper presented at the annual meeting of the American Society for Testing Materials, June 22-26, 1915, by Jesse L. Jones.

Photographs from the Field

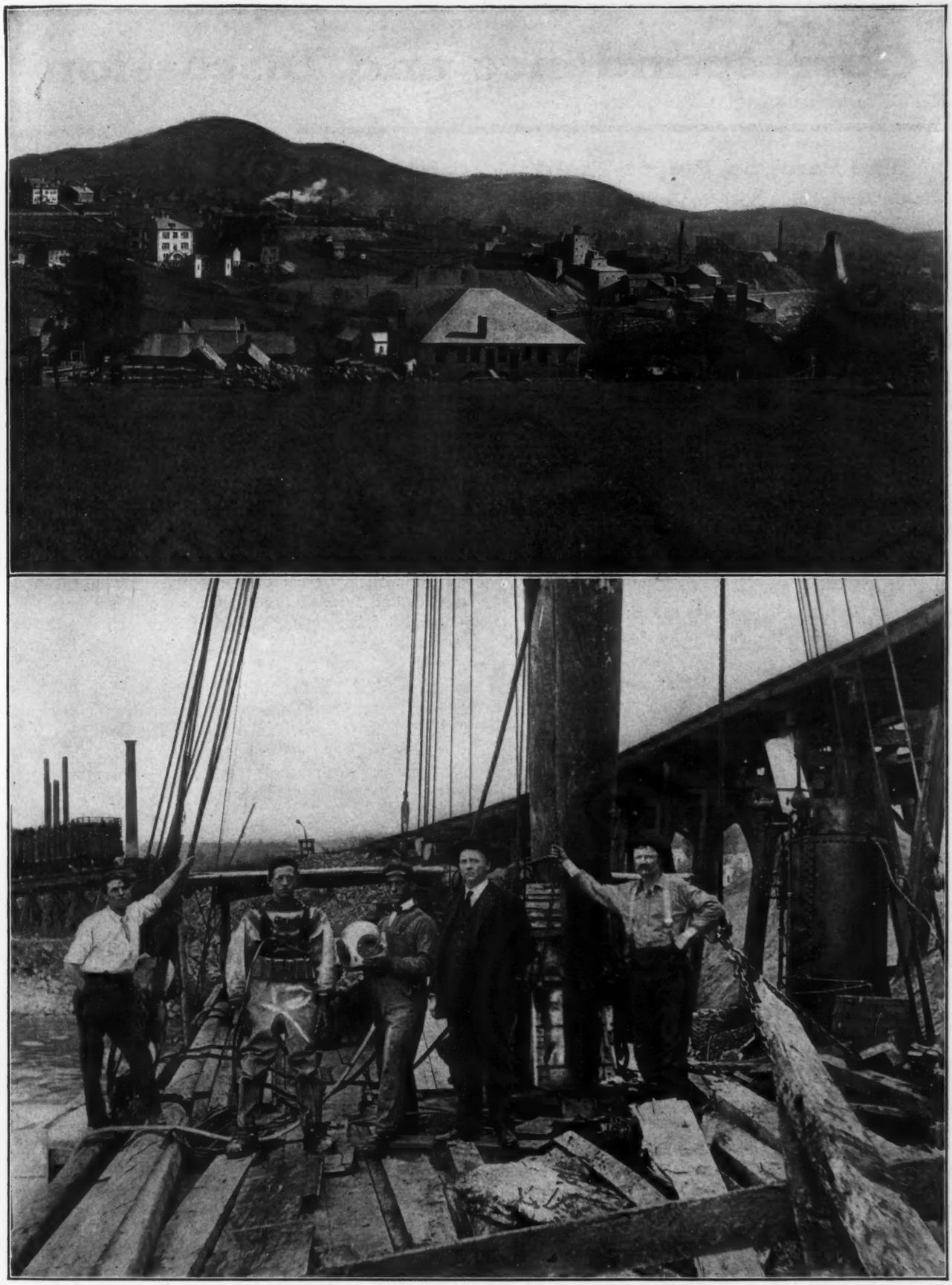
FIGS. 1 TO 4. VIEWS OF THE ALASKA-GASTINEAU MINING CO.'S ANNEX CREEK POWER PROJECT

1—Lower camp, showing power-house foundation, part of pipe line and tram to Lake Camp. 2—Upper camp at tunnel to tap upper Annex Lake. 3—Portal at tunnel. 4—Tramway along Carlson Creek



LOCOMOTIVE ON 1,700-FT. LEVEL OF PORTLAND MINE, IN THE CRIPPLE CREEK DISTRICT, COLO.

This level was opened since the drainage of the mine by the Roosevelt tunnel.



TWO PHASES OF THE IMPORTANT IRON-MINING DISTRICT OF NORTHERN NEW YORK STATE

Upper view is of the town of Mineville, N. Y., and the lower of a diver at work at the ore dock at Port Henry. The diver recovers ore lost from the docks

Correspondence and Discussion

The Pamlico Placer Field

In the *Journal* of Sept. 25, in the Mining News, under head of Inyo County, California, is a reference to the Pamlico placer field at Bishop. All the data are correct, but the Hawthorne mining district is in Mineral County, Nevada. Hawthorne, the county seat, is about 10 mi. west of Pamlico camp. The *Journal* may have received its item from Bishop, but with that post office address given it might be misleading, as there are other Hawthornes.

The Pamlico company has a new gallows frame, a gravel bin, also a 25-hp. gas hoist. The water for sluicing is brought 14 mi. from the southwest through a pipe line put in many years ago for a mill. About 25 men are now working on the two shifts. The placer gold is thought to have come from the Pamlico Hill, about one mile southeast of the present workings. Twenty-odd years ago ore reported to be worth from $100,000 to $150,000 per ton was taken from this hill. Some of the placer gold is very coarse. The surface was dry-washed years ago, but this is the first attempt to placer on a large scale. The company is down 120 ft. to bedrock. Nuggets as large as three troy ounces have been found.

Hawthorne, Nev., Oct. 9. W. P. Ross.

Chain Ladders Unnecessary!

On Oct. 10, four men were working in the bottom of the 1,780-ft. 3-compartment shaft at the Oro Hondo mine, near Lead, S. D. They had completed a round of holes and given the blasting signal to the engineer. The latter responded, and the fuses on the 12 charges were lit. The four men climbed on the bucket and gave the signal to hoist. For some reason this was not done as soon as they supposed it should be, and thinking something had gone wrong with the engine, the foreman jumped off the bucket with the intention of cutting the fuses. In climbing off the bucket he dropped his lamp and it went out. In the meantime the engineer, following the signal given him, hoisted the bucket with the three men on it.

When the bucket reached a place above the main bulkhead, the men on it gave the signal to stop, and climbed out on the timbers out of danger. They then signaled the engineer to lower the bucket, which he started to do. Before the bucket reached the bottom the man who was left there tried to climb the bell rope. In doing this he gave the one bell signal and stopped the hoist, at the same time breaking the bell cord. The engineer waited a reasonable length of time and not getting any signal hoisted the bucket to the station. Not finding any men on it he lowered it into the shaft, but before the bottom was reached the shots commenced. The three men that had gained the timbers climbed to the station by means of ladders.

The man at the bottom during this time realized that there was very little hope for him and crouched behind the lagging in one corner of the shaft. The 12 shots went off and completely covered him. There was little hope entertained by those above for his recovery, but an examination was immediately made and it was found that he was alive. Superintendent Talbot, with the aid of the night engineer, went into the shaft and after 30 minutes' work was able to get the man's head out. Some more hard work and he was uncovered and taken to the surface. It was at first supposed that it would be impossible to get him out before the water came up in the shaft and caught him. It was done, however, and an examination of the man after the accident showed that he was only slightly bruised on the side of his head. What might have proved a sad affair turned out without anyone being seriously injured. It is a lesson to those employed in shafts to have some other means of exit in case of necessity.

A chain ladder had been supplied the men with which to reach the first bulkhead, but it was several sets above and had not been lowered. Someone had been careless and had not followed instructions. There had never been any occasion to use the ladder before, but when the time came it was not in its place. Fortunately no one was injured, and from the occurrence a good lesson can be had, in that two methods of getting out of a shaft are absolutely necessary. S. E. B.

Lead, S. D., Oct. 16, 1915.

[One of which methods is, not to depend on climbing the bell rope. Even though the man was not killed the entire shaft crew should have been promptly fired. Why provide *two* methods of getting out when one reliable method provided was entirely disregarded?—Editor.]

The Cost of an Ounce of Gold

Our attention has been called to an interesting article in the *Journal* of July 10, 1915, entitled "The Cost of an Ounce of Gold," in which the author, Percy E. Barbour, states in the second paragraph that "the cost of producing an ounce of gold is not only not commonly known, but is not included in the report of any gold-mining company which has ever come to the notice of the writer."

We think the latter will therefore be interested to learn that the group of gold and silver mines in the Benkoelen district of Sumatra, under the direction of our Batavia principals, Messrs. Erdmann & Sielcken, have for some years past regularly published monthly reports in which the cost of production per ounce of gold is shown and even is subdivided into various branches of the working operations. Silver is also produced, but, being of secondary importance, is reduced to its equivalent value in gold for the purpose of calculation.

We inclose copies of the monthly report[1] of the mines Redjang-Lebong, Simau and Ketahoen for December, 1914, as published in Holland.

London, E. C., Oct. 5, 1915. ASCHHOFF & Co.

[1]These reports show the cost of gold at the three mines mentioned to have been respectively, $15.41, $11.26 and $27.34 per oz.

Dynamite Explosion at Granite Mountain Mine

BUTTE CORRESPONDENCE

At 1:20 o'clock, Oct. 19, the explosion of 13 boxes of giant powder at the collar of the North Butte company's Granite Mountain shaft, Butte, Mont., caused the instant death of 14 men and the serious injury of four others, two of whom have since died in the hospital.

Three times a week powder is sent down into the mine. The day of the accident was "powder day." The chippy cage upon which the powder is lowered does not run to the 2,800-ft. level and one car intended for that level, containing 650 lb. of dynamite, was held back to be lowered on the big cage coming up from the 2,800 level. Three loads of 13 boxes of powder each had already been lowered on the chippy, but before the big cage came to the surface to take the last box down to the 2,800-ft. level, the explosion occurred. While numerous theories have been advanced as to the cause of the explosion, the true one will probably remain a mystery, as the men handling the powder were all killed. The damage to the plant was comparatively slight. Manager Pope, of the North Butte company, after careful investigation stated that he had no theory whatsoever as to the cause of the explosion. The accident, which marks the worst tragedy in Montana's mining history, has been a severe shock to the community. Those numbered with the dead were all men highly esteemed by their employers and friends. Expressions of sympathy have reached the bereft survivors from all quarters.

The dead: James E. Blow, assistant foreman; Richard Gendle, electrician; George Larkin, nipper; John Winston, shift boss; Ed. Carlson, top carman; Robert Watson, shift boss; Ernest Watson, shift boss; Edwin C. Bray, shift boss; John McCauley, boss ropeman; Patrick J. Morrissay, shift boss; James Powers, nipper; William Danton, electrician; William Butcher, nipper; Phileas Blanchett, miner; Lacey Grisham, shift boss; John D. Leahy, nipper.

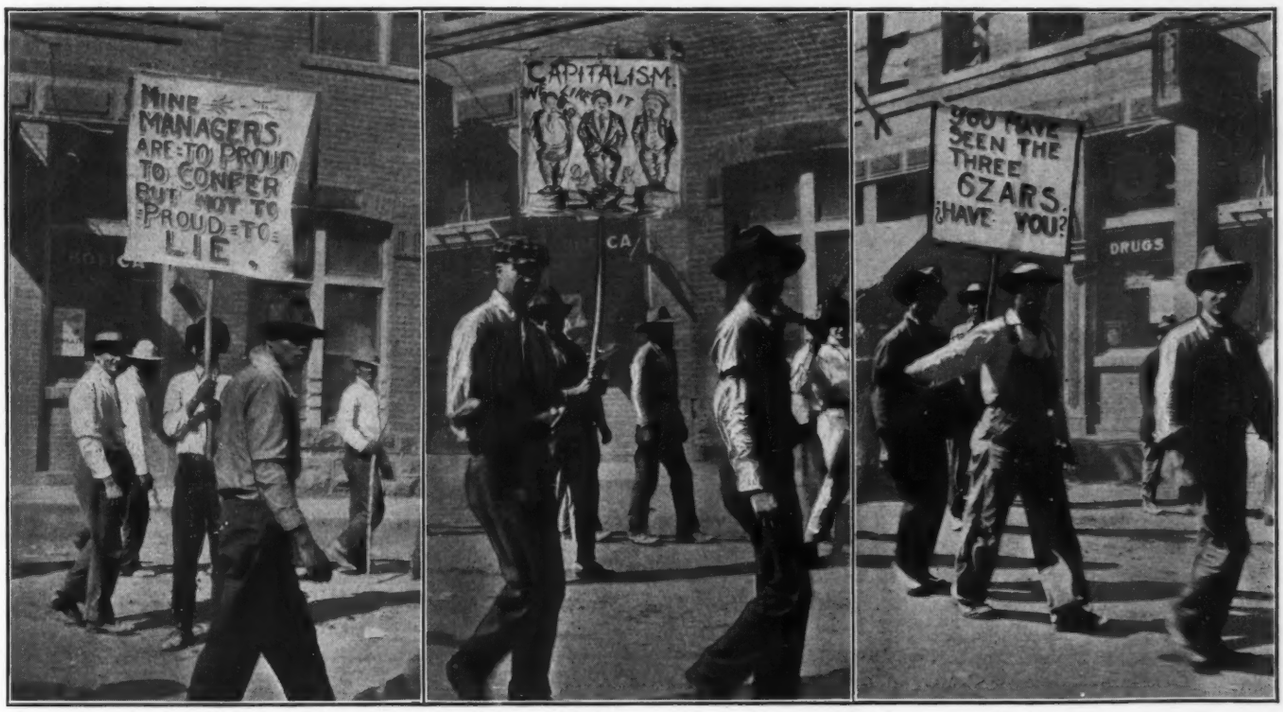
Seriously injured: Peter H. Brown, carpenter; William Vallentine, carpenter.

The Strike Situation in Arizona

SPECIAL CORRESPONDENCE

A condition of pacification reigns at Clifton, Morenci and Metcalf despite reports to the contrary. Physical damage to the extent of probably $125 has been done to the three camps, and many men have been driven from the districts and several injured.

Beyond a doubt the labor strike at the colossal mining camp has been one of the most remarkable in the history of similar events. It is different in that no strike-breakers have been brought into the camp by the operating companies, no liquor has inflamed the minds of the strikers, no serious agitators have attempted a "stampede," and few have resisted the demands of the strikers, save by departing. There has been much of what journalists call "sob stuff" sent out from the Clifton-Morenci mining districts, but the true story of the situation is one of "watchful waiting."



SOME TYPICAL BANNERS DISPLAYED BY THE STRIKERS DURING THE CHASE CREEK DEMONSTRATION

The most disastrous results of the strike have been in disorganizing well-formed operating crews, stopping the movement of the wheels of industry, and the bitter taste left by the occurrence. As for the battles, dynamite destruction, starvation, etc., the accounts must be discredited.

Late in August organizers of the Western Federation of Miners entered the mining camps of Clifton, Morenci and Metcalf, Ariz., in which the Arizona Copper Co., Detroit Copper Co. (Phelps, Dodge & Co.) and the Shan-

ıon Copper Co. operate. A mass meeting was held on Sept. 4 on the streets of Metcalf and again the following evening at Morenci. Banners with the inscription *Viva la Union* were displayed. The plaza was crowded with union sympathizers, and the opposition remained on the edge of the crowd. On Sept. 6, Guy Miller, organizer of the Western Federation of Miners, made an address in Clifton, after which a demonstration was held and *Viva la Union* again became the center of attraction. The crowd maintained order at all times. Mr. Miller then outlined the procedure of the Western Federation of Miners in Clifton and announced that upon the completion of organization a committee would present their demands to the officials of the three operating companies and stated that if, after a limited time, the demands were not met with, a strike would be called. Mr. Miller advised the men to conserve their savings and be prepared for the worst. Prior to this announcement many Federation organizers had gone over the Clifton labor situation, and it may be safe to say that plans for action were laid as far ahead as June. Mr. Miller's plans were followed out, and a committee requested an interview with the company managers. In answer, M. H. McLean, of the Detroit company, advised Mr. Miller that the Federation would not be recognized. J. W. Bennie, manager of the Shannon Copper Co. was in California when he received word of the requested committee meeting, and he wired his refusal. Normal Carmichael was also away at the time, but took a stand similar to that of McLean and Bennie.

On Saturday night, Sept. 11, a strike was ordered, and by 3 o'clock Sunday morning not a wheel moved in any of the mines, mills and smelteries. With the striking miners all other union employees walked out in sympathy. Guards were stationed for the protection of the company's property and pickets placed by the strikers. It was then announced that the men would demand from the companies the same wage scale as paid at Ray, Ariz. The company officials then stated that they would meet a committee of the workingmen as such, but not as members of the Western Federation of Miners. No effort was made to operate any part of the mines, mills or smelteries, and no strike-breakers were imported. This was one of the wisest moves during the entire situation. The next move made by the companies was to turn over all their property to the protection of Sheriff James Cash of Greenlee County, requesting him to protect it from any violence, and they withdrew their own watchmen. Sheriff Cash appointed about twenty deputies whom he placed over the property.

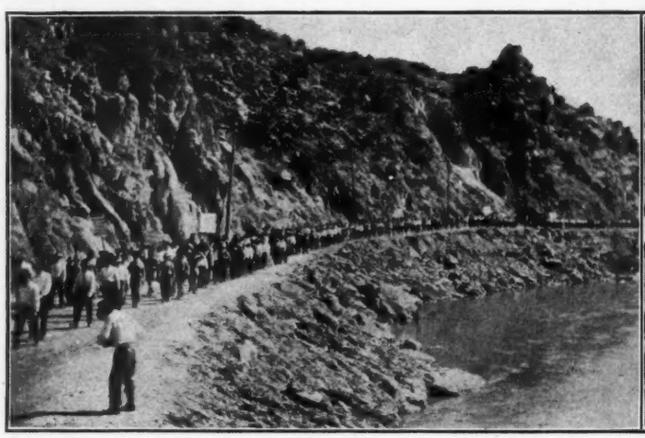
On Tuesday, Sept. 28, Governor G. W. P. Hunt arrived in Clifton shortly after 10 o'clock from Phœnix. From then on whatever violence was to take place made itself known.

On Saturday night, Oct. 2, Managers Carmichael, McLean and Bennie decided to leave Clifton, and went to Lordsburg, N. M., where they were arrested on a charge of being fugitives from justice. J. W. Bennie stated that it was his belief that the sheriff was planning to place them (the three managers) in the county jail, fearing violence of the strikers. Rather than be placed in the hands of the county, they left camp on a special train. Under-Sheriff Joe Larrieu was in Lordsburg and was informed of the departure of the managers. He made a complaint on a fugitive-from-justice charge and the three officials were placed under arrest by the sheriff of Grant County, New Mexico. At midnight Sheriff Cash arrived by automobile and held a warrant charging the managers with inciting a riot, presumably for leaving the camp. The justice of the peace dismissed the case, and the men left for El Paso, where they established headquarters in the Hotel Paso Del Norte.

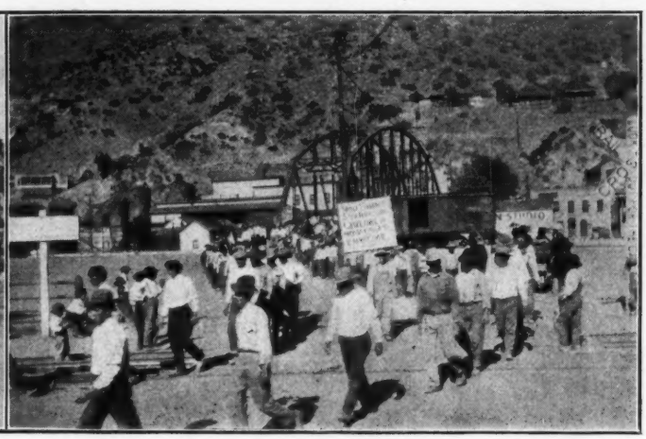
The violence that ensued in Clifton comprised the following incidents: The engineer and fireman who brought the managers to Lordsburg were severely beaten up by the strikers, as were several other workmen; windows in the Arizona Copper Co.'s office and drug store were broken; the engineer at the light plant was overpowered and the lights turned off; and a charge of dynamite was reported to have been set off at Morenci. A great many persons were ordered out of camp and many left, some forming a colony at Duncan, Ariz. Others went to other mining camps in the Southwest. Parades were held, and banners bearing glaring inscriptions were brought on the scene.

On Oct. 4 about 40 members of the Arizona National Guard were sent to Clifton by Governor Hunt, and later a request was made by the sheriff and others for more troops, which were sent. The militiamen camped near the Arizona Copper Co.'s smelting plant and at the courthouse.

Moyer left Clifton on Oct. 6, to consult with Governor Hunt in Phœnix. He said that the Federation would withdraw all requests for recognition and all that it asked was a decent wage scale for the employees. He considered the requests of the managers incoherent in regard to the "dominant influence." He agreed that if the presence of



PARADE OF 5,000 MEXICAN EMPLOYEES AT CLIFTON



THE DEMONSTRATION ON THE PLAZA AT CLIFTON

himself or any of the Federation organizers retarded a settlement they would be only too glad to leave the district. He gave the solution as being in a meeting of the managers with the employees.

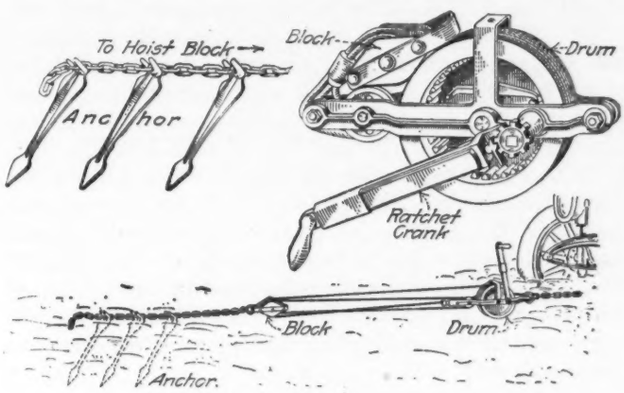
Several attempts have been made to send committees to El Paso to meet with the managers, but only one has been accepted. It consists of Hollingsworth, Hughes, Palacios, Garcia and Daley.

The latest communication from El Paso contains the information that at the conference between the managers and the committee of employees, they had not been able to agree. The managers stipulated that the Western Federation of Miners must be eliminated and that the employees must return to work under the former scale of wages. No other conditions would be considered. The employees' committee, not being willing to accept these terms, returned to Clifton.

A Little Thing with a Big Pull

An ingenious piece of mechanism devised for the automobilist to enable him to pull himself out of a hole looks as if it would be a very handy contrivance to have around a mine.

The device is known as "Pull-U-Out," and is in effect a miniature chain block, and is simplicity itself. A substantial winding drum, with gears inside, engaging a small bronze gear on the end of a long ratchet crank, furnishes the pull. At the other end of the tackle is a small double block; 40 ft. of steel cable, with a capacity



THE PULL-U-OUT DEVICE

of 5,000 lb. is used. Two 7-ft. pieces of light-weight chain, with hooks on each end, complete the outfit.

In order to furnish an anchor where there is no stump or fixed object to tie to, three light-weight steel stakes are provided with each "Pull-U-Out" outfit. These are to be set in the ground, tandem fashion, about a foot apart, leaning toward the object to be pulled—not away from it, as one would suppose. When driven in in this fashion and the chain fastened to the three stakes, it is claimed that 50 men could not pull them out with a side pull, but that when the tension is released they can be easily pulled up on the same angle at which they were driven. The manufacturers say "the device itself is clever, but these three stakes are more than clever."

Underground, this little device ought to prove of immense advantage many times. The handling of big timbers in stopes would be much facilitated or the handling of timbers in a raise or winze.

The handling of the sinker pump when shaft sinking, or the placing of additional lengths of water column, especially when the size is large, furnish other applications for this device. In fact there are so many ways in which this device can be used to advantage around the mine, both on top and underground, that it ought quickly to become the miner's friend. Its portability is as great an attraction as its pulling power.

The complete outfit is sold by the Pull-U-Out Sales Co., 2018 Market St., St. Louis, Mo., for $15. The accompanying sketch shows this interesting, cheap and promising little device.

British Prize Court Decides Against Merton & Co.

The British prize court, on Oct. 6, 1915, decided against Henry R. Merton & Co. in the matter of freight charges on 6,710 tons of zinc concentrates seized on the steamship "Bilbster." The cargo was consigned by the Australian Metal Co. to Henry R. Merton & Co., of London. The latter had advanced £5,000 to the shipowners on account of freight charges of £7,546 and brought an action against the Crown for a refund of this freight payment on the seized cargo.

The Crown contended that the concentrates were "enemy goods," and this was admitted by Merton & Co., as they had become the property of Beer, Sondheimer & Co. The shipowners, meantime, put in a claim for the full amount of their freight. An award of the balance, £2,546, was allowed the shipowners by the court, but the claim of Merton & Co. for refund of the £5,000 was disallowed on the grounds that they had acted as agents for the Metallgesellschaft of Frankfort on Main and that the money had been paid to the shipowners on behalf of the German firm with the idea of retaining the goods for the German owners.

Another zinc cargo of about 5,000 tons, shipped by the Australian Metal Co. prior to the war, on the S.S. "Manningtry," was condemned as being practically the property of the Metallgesellschaft. It was claimed by the Australian Metal Co., Henry R. Merton & Co., the Cie. des Minerais, of Belgium, and another firm.

Australian Wolframite and Molybdenite Situation

The Federal Government of Australia has recently issued a proclamation in the molybdenite, scheelite and wolframite districts of Australia, according to the *Australian Statesman and Mining Standard*. The following is an abstract of this proclamation:

The Commonwealth Government has entered into an arrangement with the Imperial Government for a period of 12 months, to acquire, for the Imperial authorities, all the molybdenite, wolframite and scheelite produced in Australia. For the purposes of this arrangement the Commonwealth Government has appointed Dalgety & Co. as its agents. The price payable to the producers at the following places is to be not less than the following amounts: Wolfram Camp—Wolframite or scheelite, 45/2; molybdenite, 90/10. Bamford, 45/6, 91/1. Cairns—F.o.b., 46/6, 91/10. Townsville—F.o.b., 47/4, 92/6. Port Darwin—F.o.b., 47/2, 92/8. Melbourne—Ex-rail or ship, 48/1, 93/10. Sidney—Ex-rail or ship, 48/1, 93/10. Prices at other fields, if any, will be fixed on a similar basis. Provision has been made for the compulsory acquisition of any of these minerals which are held back, and this arrangement supersedes all existing contracts for the sale and disposal of these minerals, but does not otherwise interfere with the position of agents or their arrangements with producers.

Editorials

The Situation in Spelter

The continued strength of the spelter market in the face of steadily increasing production and a diminished consumption for domestic peaceful purposes has been a matter for surprise among students of the situation. A few months ago it was the fashion to prophesy that the trend of spelter would be steadily downward but time has passed and the expected has not happened. This does not, however, prove the prophets wrong. It is a common mistake to misgage the time in which clearly discerned factors are going to develop.

Thus, in the case of spelter itself, when the war began, the first idea among American zinc producers and merchants was that there would be a great foreign demand for our spelter. Such a demand did, in fact, appear soon, creating what was then considered a great boom in spelter, the price rising to something like 6c., but when this demand slackened there was a relapse and pessimism reigned again. By December the great boom in spelter that had been forecasted in August was forgotten. It began in January, however, and then soon demonstrated itself as being the real thing.

A little while ago attention was focused on the additions to smelting capacity that were so extensively and so rapidly being made. The deduction was promptly drawn that this would result in a collapse in the price for spelter. When that failed to happen right away, the idea seemed to be forgotten. The price for spelter rallied, and no longer were lists published showing how many new retorts were going to become productive in October, etc.

Renewed attention is drawn to this, however, by the actual beginning of smelting at certain of the large new plants, namely, those at Donora and at Kusa. The Donora plant was put in operation on Oct. 21, just four months and ten days after construction was commenced. In antebellum days 18 months would have been regarded as a conservative estimate of the construction period of such a plant. The ratio of 18 to 4⅓ is not, however, a precise statement. Donora at present is still far short of the point where it may be regarded as complete, although it has reached the point of producing some spelter.

Besides the new zinc-smelting plants that have previously been mentioned, several other little plants are going up in a variety of places. This is natural when spelter rules so high and ore relatively so cheap, and in the end such increase of capacity will of course bring about its natural result. In considering why a weaker tendency in the spelter market has not yet become manifest, it must be borne in mind that during the extraordinary boom that prevailed from about the beginning of April to the end of July, a large part of the expected production of the smelters during the last quarter of the year was sold. Consequently, smelters are still busy in making deliveries on their old contracts, and unsold stocks of spelter have not yet begun to accumulate to any considerable extent, although there has been, without any doubt, a certain accumulation during the last six weeks. In the meanwhile the market has been supported by a renewed and extraordinary foreign demand, although this has not attained any very great proportions. Certainly there has been nothing of late to cause a revision of opinion as to what is ultimately going to happen in the spelter market.

Anaconda's Campaign for Safety First

A recent number of the *Anode,* one of the monthly magazines published by the Anaconda Copper Mining Co. in furthering its campaign for the lessening of accidents in its mines and works, contains some interesting data for the first semester of 1915. The most important part of these is a matter of pure statistical practice. The accident rates reported by state authorities are computed by dividing the number of accidents—say the fatal ones—by the number of men employed on the average. Let us say that in the mines of Butte there were 52 men killed in a year and the average number of men employed was 13,000. The fatality rate would be 4 per 1,000. It has long been recognized that this is nothing but a rough method. The divisor is largely a matter of guesswork, while even if it were correct there would enter into consideration the probability—nay, certainty—that all of the men do not work all of the time. This tends to make the division too high and the quotient too low. The correct basis is of course the number of accidents per 300 thousand man-days; that is, per thousand men if all worked 300 days—assumed to be a full year. The statisticians of the United States Bureau of Mines are trying to introduce this system. It would be rendered relatively easy if all of the big mining companies should adopt it.

The Anaconda company has adopted it in a way, reporting its "fatal and serious" accidents upon a basis of 10,000 shifts. The idea of this is correct, namely, to put things on a definite basis, but the method of doing it is rather unfortunate, preventing as it does the comparison of its figures with any others, for two reasons—the divisor and the classification both being odd.

Respecting the matter of classification, "What is a serious accident?" On this subject the committee of consulting engineers that made a report on "Rules and Regulations for Metal Mines" for the United States Bureau of Mines said: "To define properly a 'serious' accident is somewhat difficult. About the only feasible method of differentiating 'serious' from 'minor' accidents is on the basis of the length of the period of disablement. The committee has made the dividing line 14 days. This is a figure commonly so taken in reporting mine accidents and corresponds with the length of time elapsing before an injured employee receives compensation, according to most of the compensation laws of which the committee has knowledge."

In reporting accidents the one sharply dividing line is that between fatal accidents and all others. If a man be killed, that is certain and there is no question of making fine or arbitrary distinctions as to whether the accident was serious or not. But the lumping of fatal and serious accidents leaves us quite in the dark.

In the first six months of 1915 the average of fatal and serious accidents in the Anaconda mines was about 1.80 per 10,000 shifts; or we may estimate about 1.80 per 400 men per month, assuming 25 man-shifts per month or 4.5 per 1,000 men, and the rate per annum would be 12 times as much, that is, 54. However, this figure is not comparable with anything else that we know of. In the first quarter of 1915 the average of fatal and serious accidents in the Anaconda mines was 1.92 per 10,000 shifts per month. In the second quarter it was 1.69, a gratifying reduction, but the periods are too short to permit of any reliable deductions respecting the influence of the "safety-first" movement.

The same number of the *Anode* contains some interesting notes about the Washoe mine, one of the Anaconda's collieries. Loose rock on the sides of the entries and roadways are to be removed regularly by the company—a commendable thing. It having been observed that in hoisting men at end of shift they would jump off the cars before the latter had come to a stop, a gate has been placed at the main exit of the shaftway, which is opened only when the trip has come to a stop. This also is a good thing. Many shaft accidents result from the men's crowding on the cage in excess of the regulation number, from skylarking on the way up and from disobedience of rules generally.

Standardization of Data

The Mining and Metallurgical Society of America is undertaking, with the aid of a distinguished committee, work in the direction of the standardization of technical definitions and practice. The Institution of Mining and Metallurgy has already accomplished important work of this nature, and some attention to the subject has been given by the Canadian Mining Institute. The committee of the Mining and Metallurgical Society lately made its first report, which was to a large extent a review of previous reports by the Institution of Mining and Metallurgy, the idea being that the three organizations shall proceed on the same lines.

This is an important piece of work, tending toward precision of statement and clarification of ideas. Whenever a technical man gives any data, everybody should be able to know just what he means. The chances for confusion are greater than many persons realize. Thus, one zinc smelter may refer to a certain works as having four furnaces and another may tell of the same works having eight furnaces. The latter upon interrogation would explain that the works had eight furnaces, but only four blocks.

Even the definition of a word, commonly dismissed as merely a concern of the lexicographer, may become a matter of great consequence. Thus many thousands of dollars were spent a few years ago in tariff litigation that hinged on the definition of calamine, notwithstanding the fact that a long time previously it had been pointed out that trouble was likely to occur owing to the confusion about that name that existed. This question has not yet been cleared up, a change in the tariff law having removed the acute necessity for settling it.

These are merely examples. They show that the more that uncertainties can be eliminated the better will things be. Such work as the Mining and Metallurgical Society and the other organizations may do in this way will therefore be very helpful.

Zinc Smelters' Profits

Contrary to the popular idea, the zinc smelters do not always make money, no matter how extensively they "rob" the miners whose ore they buy. In fact, a good many of the ventures in zinc smelting have been disastrous to those who put their money into them. The extraordinary turn of the tide in 1915, however, has enabled almost everybody to make money in smelting, no matter how imperfect his plant and methods, and several of the concerns that previously were in a bad way have been enabled not only to get their accounts into good shape, but also to arrive in a position for the payment of dividends.

Thus the American Zinc, Lead and Smelting Co., which about a year ago was practically a derelict with neither money nor credit, has paid off its indebtedness of about $1,750,000 and ere long will probably be considering the payment of a dividend. The Lanyon Starr Smelting Co., which for a number of years has not earned enough to pay dividends, even on its preferred stock, recently declared a dividend of 24% on that class of stock, to provide for all cumulative dividends up to July 1, 1915.

Zinc smelting has been very profitable during 1915, but it has been the big zinc-mining companies, like the New Jersey Zinc Co., Granby Mining and Smelting Co., Butte & Superior Copper Co. and Interstate-Callahan Mining Co., that have earned and paid the speculator dividends. The earnings of the American Zinc, Lead and Smelting Co., moreover, are derived to a greater extent from its Mascot mines than from the smelting branch of its business.

Copper Mines in Serbia

A good deal of nonsense is being printed in the daily newspapers about the great supplies of copper that the Teutonic allies are going to gain when they have conquered Serbia. The copper mines of Serbia are, indeed, a little more important than the alleged copper mines of Poland, but they have never been largely productive. The only copper-producing concern is the company owning the Bor mines, which previous to the war produced six or seven thousand tons of copper per annum.

The shortage of ships, previously a matter of great concern, was rendered more acute by the blockade of the Panama Canal. A large number of vessels waiting at the entrances were obliged to hoist anchor and steam around Cape Horn, thus depriving commerce of their carrying capacity for two or three months. Several cargoes of Australian zinc ore were thus caught. The ships bringing it have been sent around Cape Horn, excepting one which was ordered to San Francisco, whence the ore is to be brought overland to the smelters.

BY THE WAY

Dispatches of this week again report that Villa has taken possession of the Chihuahua smeltery of the American Smelting and Refining Co. and will smelt some of the confiscated silver-lead ore that the company has declined to treat, "owing to the absence of its technical staff."

⁂

At the meeting of stockholders of the Southern Aluminium Co. in New York on Oct. 23, it was voted to dissolve the corporation. Action of the Paris directors is now being awaited. It has been rumored that L'Aluminium Française may take over the American project at Whitney, N. C.

⁂

Death Valley Scotty, the mysterious man who had the whole Western country guessing in the days of the Goldfield excitement, has again shown up, this time at San Bernardino. He carried with him the usual bag of high-grade and this time reports that his new find is located at Twenty-nine Palms, in the Colorado desert.

⁂

The new zinc-smelting plant that has been constructed at Donora, Penn., is variously described as being of the United States Steel Corporation, of the American Steel and Wire Co. and of the Edgar Zinc Co. This explanation is that the United States Steel Corporation owns the American Steel and Wire Co., and the latter owns the Edgar Zinc Co. The actual management of the Donora plant is vested in the officials of the Edgar Zinc Co., and the ore contracts, etc., are made in the name of that company.

⁂

Following the *Journal's* custom, the final standing of the chief baseball leagues is given below for the benefit of the subscribers in the "jungle":

AMERICAN LEAGUE

	W.	L.	Per Cent.
Boston	101	50	0.669
Detroit	100	54	0.649
Chicago	93	61	0.604
Washington	85	68	0.559
New York	69	83	0.454
St. Louis	63	91	0.409
Cleveland	57	95	0.375
Philadelphia	43	109	0.277

FEDERAL LEAGUE

	W.	L.	Per Cent.
Chicago	86	66	0.566
St. Louis	87	67	0.565
Pittsburgh	86	67	0.562
Kansas City	81	72	0.530
Newark	80	72	0.527
Buffalo	74	78	0.487
Brooklyn	70	82	0.461
Baltimore	47	107	0.305

INTERNATIONAL LEAGUE

	W.	L.	Per Cent.
Buffalo	86	50	0.632
Providence	85	53	0.616
Toronto	72	67	0.518
Rochester	69	69	0.500
Montreal	67	70	0.489
Harrisburg	61	76	0.445
Richmond	59	81	0.423
Jersey City	52	85	0.380

NATIONAL LEAGUE

	W.	L.	Per Cent.
Philadelphia	90	62	0.592
Boston	83	69	0.547
Brooklyn	80	72	0.527
Chicago	73	80	0.477
Pittsburgh	73	81	0.474
St. Louis	72	81	0.471
Cincinnati	71	83	0.461
New York	69	83	0.454

The post-season series, Boston vs. Philadelphia, was won by Boston, 1-3; 2-1; 2-1; 2-1; 5-4.

⁂

It is only a few years since smelting plants were being closed because they were distributing sulphuric acid over surrounding farms. Now comes the announcement that the smoke question is to be settled by the production of sulphuric acid and its application to the alkali lands of the Western States. At the engineering convention in San Francisco, Dr. C. B. Lippman, of the University of California, announced that apparent beneficial results have been obtained by the application of sulphuric acid to alkali soils. Views were presented, depicting crops grown on test plots that had received from 2½ to 7½ tons of sprayed sulphuric acid to the acre, the ground previously having been unfit for agricultural purposes on account of alkali salts. There is much alkali land around certain smelting plants in the West, and the smelters would welcome a profitable outlet for the sulphuric acid that they could produce. Thus it may be proved to them that "damage" as well as dirt is merely "matter out of place."

⁂

Bethlehem-Pennsylvania Deal

A week ago it seemed certain that the controlling interest in the Pennsylvania Steel Co. would pass to the Bethlehem Steel Co., as then stated. There seemed to be no doubt that Mr. Schwab's bid would be accepted by both the Pennsylvania Co. and the Reading Iron Co., whose holdings of the Pennsylvania Steel stocks constitute a very large majority. Indeed, it was stated on the best authority that Schwab's bid was satisfactory to the Pennsylvania people, and that it only remained for the Reading Iron board to approve of the transaction.

An unexpected obstacle has arisen, however. As is well known, William H. Donner, president of the Cambria Steel Co., has for some time held an option on the Pennsylvania Steel stock at a fixed price, with the further provision that he should have the first call on the stock in case a higher price should be offered by anyone. It now seems that Mr. Donner has given notice that he will meet the Schwab bid, and the transfer is uncertain pending further negotiations. It is said that H. C. Frick is backing the Donner party.

⁂

Utah Potash Production Begins

SALT LAKE CORRESPONDENCE

The production of potash on a commercial scale in Utah has been started. The plant of the Mineral Products Co., at Marysvale, began operating in its entirety for the first time Oct. 19. The roasters had been warmed up and tried out some time before this, and the plant was ready by the middle of September, but on account of the reconstruction of the tramway from the mine to Cottonwood Cañon, operations were delayed until this week. The capacity of the first unit, which is complete in itself, is 100 tons a day. Other units will probably be added.

The alunite contains about 11% of potash. It is roasted to form a soluble potassium sulphate, and this is leached out with water and evaporated to a solid salt from the solution. From 25 to 30 tons of potassium sulphate running over 90% will be produced daily, and the first carload shipment, according to Charles E. Macdowell, vice-president of the company, will consist of 93% concentrated sulphate of potash, and will be shipped some time during the week to a firm in Florida. The percentage is higher than that of the German product, which seldom ran above 90%. At present the output will be hauled 6 or 7 mi. to the railroad by motor trucks, but a side track will be built to the plant by the Denver & Rio Grande R.R., in the near future. Pure alumina is obtained from the residue of the alunite after leaching and is a valuable byproduct.

PERSONALS

Whitman Symmes, of Virginia City, Nev., has been in New York.

W. A. Wilson, mining engineer, has removed his offices to the Dooly Block, Salt Lake City, Utah.

Ernest J. Ristedt, chemist for the Old Dominion Copper Co., Globe, Ariz., has been paying a brief visit to his former home in Denver.

H. V. Dardier, accompanied by an engineer representing the Vickers-Maxim Co. of London, has been investigating nickel deposits near Fond du Lac, Manitoba.

A. W. Soderberg has been appointed chief mechanical engineer of the Homestead Steel Works of the Carnegie Steel Co. in place of R. H. Stevens, who has gone to the Midvale Steel Works.

Roy J. King, of Tonopah and Grass Valley, who spent August and September in Alaska and British Columbia, has returned to the States, and now is in Oregon on professional business.

F. C. French sailed from Seattle for Alaska on Sept. 14. He will be constructing engineer on the reconstruction and enlargement of the plant of the Beatson Copper Co. at Latouche, Alaska.

F. E. Marcy has resigned as local manager of the Mine and Smelter Supply Co. at Salt Lake City. He will devote his time to the sale and manufacture of the Marcy mill, which is controlled by the company.

C. E. Addams, for some time connected with the De Beers Consolidated Mines in South Africa, and later with the Ray Consolidated, has been appointed general manager of the Ray Hercules Co. in Arizona.

Jesse Lee Jones, who was chosen president of the American Institute of Metals at the recent annual meeting, is chief chemist and metallurgist of the Westinghouse Electric and Manufacturing Co. of Pittsburgh.

J. J. Warren, president of the Kettle Valley Ry., has been added to the board of directors of the Consolidated Mining and Smelting Co., of Canada, operating Trail, B. C., smelting works, and has been appointed managing director.

Thomas M. Skinner, Jr., having finished the chemical work in which he was engaged at Keeler, Calif., pertaining to the alkali waters of Owens Lake, has returned to Colorado and is temporarily engaged with the Empire Zinc Co. at Denver.

T. Hirabayashi, H. Nakamuta and S. Nakagawa, mining engineers representing the Japanese government, recently spent one week inspecting ore- and coal-dock facilities in the Duluth-Superior harbor, also the plant of the Minnesota Steel Co., near Duluth.

F. O. Williamson, who represents the Hardinge Conical Mill Co., T. L. Smith Co. and Smith Engineering Works, in Chicago and adjacent territory, is taking an extended trip through the Western mining districts, on his way to San Francisco.

H. G. Moulton, who has been with the firm of Eugene Meyer, Jr., & Co., of New York City, as consulting mining engineer for the last seven years, has recently been appointed by the Public Service Commission consulting and inspecting engineer on underpinning and excavation for the new subways in New York.

Dr. James Cole Roberts, in charge of the United States Bureau of Mines Rescue Car No. 2, with headquarters in Denver, has accepted appointment as professor of safety and efficiency engineering, the department recently authorized by the trustees of the Colorado School of Mines as a tribute to the late Dr. Joseph A. Holmes. Dr. Roberts is well fitted by experience and personality for this chair. Fifteen years ago he resigned the professorship in metallurgy in this same institution.

OBITUARY

Henry Lamy, of Paris, France, a graduate of the Massachusetts Institute of Technology in the Class of 1913 in mining engineering, was killed recently while serving in the French Army in Champagne. He was a son of Lucien Lamy, of Paris, a prominent metal broker.

George H. Abeel, whose death on Oct. 13 was briefly noted last week, was 53 years old, and had had charge of iron mines in Michigan and Wisconsin for 27 years. For a number of years he was in charge of the operations of Oglebay, Norton & Co. on the Gogebic Range. He was an active member of the Lake Superior Mining Institute from its start and was vice-president in 1913-14. He leaves a widow, a daughter and two sons, both of them mining engineers.

SOCIETIES

Texas School of Mines—Fall term has opened at El Paso with very encouraging enrollment. Special attention will be given to assay department this year.

Teknik Club—At the regular meeting of the club in Denver, Oct. 12, Mr. Eastman, of the Bureau of Mines, spoke on "Some Experiments with Basic Lead Compounds."

Utah Society of Engineers—The regular monthly meeting of the society was held in Salt Lake City Oct. 15, when W. H. Trask, Jr., deputy superintendent of the Utah Power and Light Co., gave an address on the good results to be had through the irrigation of crops by pumping systems.

American Chemical Society—The Pittsburgh Section held a joint meeting with the American Electrochemical Society at the University of Pittsburgh, Oct. 21. A large number of members attended and heard an address by F. T. Snyder of Chicago, on the use of electric furnaces. A number joined in the subsequent discussion. O. G. Schleuerderberg, chairman of the local section of the Electrochemical Society, presided. At a dinner at the University Club, before the meeting, the diners heard an address by Dr. F. C. Phillips of the University, who suggested that some technical society undertake to purchase and preserve the old Northumberland County home of Priestley, the chemist who discovered oxygen. The home is now in danger of destruction.

American Institute of Mining Engineers—The Montana Section held its semi-annual session Oct. 8, at the Silver Bow club rooms, in Butte. Between 60 and 70 members attended the meeting which was presided over by Vice-Chairman J. L. Bruce. A very enjoyable dinner preceded the technical session, at which J. A. Grimes read an interesting outline of a paper now being prepared by himself and Mr. Billingsley, entitled: "Mines in the Boulder Batholite." The paper will appear later on in the "Transactions" of the Institute. The reading of the paper was followed by a lively discussion of the theories advanced by the authors and based on facts observed in the mines so far visited by them in the district affected by the batholite. The authors are members of the geological department of the Anaconda Copper Mining Co.

American Iron and Steel Institute—The program for the meeting of the Institute at Cleveland, Ohio, Oct. 22 and 23, was: Address by President Elbert H. Gary. "Cleveland and Its Industries." Name of author, a Cleveland member, to be announced later. "Electric Furnace for Heating Billets, Castings, Etc." By Thaddeus F. Baily, Alliance, Ohio. "Modern Methods of Burning Blast-Furnace Gas in Stoves and Boilers." By Ambrose N. Diehl, Duquesne, Penn. "The Development of Alloy Steel for Commercial Purposes." By Edgar D. Rogers, Canton, Ohio. "Under-Advertising of the Steel Business." By George H. Jones, Chicago. "Recent Developments in Sintering of Iron Ores." By Bethune G. Klugh, New York. "Casting Steel Ingots." By Henry M. Howe, Columbia University, New York. Moving pictures (evening). National Tube Co. and American Steel and Wire Co. The Cleveland committee arranged for plant trips and various forms of entertainment for the members on Saturday following the regular meeting day.

Intermountain Lehigh Club—In Salt Lake City, Oct. 16, a dinner was given to Dr. Henry Sturgis Drinker, president of Lehigh University, by this club, which is made up of Lehigh alumni in Utah and neighboring states. At the dinner Dr. Drinker spoke of the increasing interest taken in modern institutions in the personality of the student, and of the duty incumbent on such institutions to use their influence in aiding in the formation of national and local movements looking toward the public good. Touching on conservation, he said that in taking wise and broad measures to utilize best our natural resources, our woods, our mines, and waters, the need was not so much to withdraw and set them aside for the use of future generations, as to be sure they were not wasted in their use by the present generation, letting them be utilized following the natural laws of supply and demand, with due regard to the essential factor that private capital will never venture into the proper broad economic exploitation of these resources, without the assurance of a sufficiently permanent tenure to insure an adequate return for investment.

Editorial Correspondence

SAN FRANCISCO—Oct. 21

The State Industrial Accident Commission has prepared a pamphlet for free distribution containing the amended Workmen's Compensation, Insurance and Safety Act. The most important of the amendments which went into effect Aug. 8, 1915, other than those relating to procedure are: (1) Extending the benefits of the law to cover injuries received in the course of employment, whether accidental or otherwise; (2) empowering the commission, in special cases, to extend the time during which medical and surgical benefits shall be furnished to injured employees; (3) providing that, in case of the loss of an eye or limb, an artificial member shall be furnished by the employer; (4) making it a misdemeanor for an employer to exact or receive from any employee any contribution, or make any deduction from his earnings, to cover any part of the cost of treatment or compensation provided by the Act. There are other changes from the original text, all of which are of general interest. Copies of the pamphlet may be had on application to the commission, 525 Market St., San Francisco.

Oil Land Suits instituted by the Federal Government involving valuable lands in Kern County are to be tried in the U. S. District Court at Los Angeles. These suits are similar to others that have been tried involving lands which are alleged to have been withdrawn from entry by the withdrawal order of President Taft, Sept. 27, 1909. The present contention of the Government is that the defendants developed oil in the land after it was withdrawn, and asks that the Government be found the owner in fee simple and that the defendants be ousted from any right they may assert; and that injunction be issued restraining defendants from further development, an accounting be had and a receiver appointed. The following named companies and corporations are defendants: Thirty-two, California Midway, Buick, Associated, Standard, California Natural Gas, and J. M. McLeod. The land is situated in section 32, and is stated to be of great value, but the value is not stated.

Midway-Sunset Oil Suits to have been tried by Judge Bledsoe in the U. S. District Court at Fresno on Oct. 18 may be assigned to another judge of the same court on account of disqualification of Judge Bledsoe who is a stockholder in one of the companies defendant. In a previous case tried, this judge made such fair rulings in favor of the Government that the Federal attorneys expressed willingness that he proceed in the present trial; but attorneys for the defendants are inclined to the notion that the cases should be tried by a jurist upon whom there can rest no shadow of bias or prejudice. These suits were brought by the Government to recover 40,970 acres of oil land in the Midway-Sunset field in Kern County, which is part of a total area of 154,197 acres included in six several suits, a part of which are to be tried in the Federal Court in Los Angeles. The land was filed on and patents issued to the Southern Pacific Co. under the act of congress of 1866 upon representation that the land was not mineral in character. The Supreme Court, however, has upheld the theory of the government geologists that petroleum oil is a mineral product. The only question now involved is whether the Southern Pacific entered upon the land in disregard of the withdrawal order of President Taft of September, 1909. That order has been upheld by the Supreme Court.

DENVER—Oct. 21

The Miner who Impounded the Water pumped from the Golden Cycle mine, Goldfield, Colo. (Cripple Creek district), collected the resulting slime and shipped his air-dried product made a close approximation to the proverbial "getting something for nothing." No other treatment was given this stuff, there was no royalty paid anybody, and the miner asserts that he has received more than $2,000 from his small shipments.

The Vanadium Mill at Vanadium, formerly Newmire, San Miguel County, Colo., controlled by the Primos Chemical Co., is operating full capacity, treating from 125 to 150 tons daily. The ore is mostly from the company's mines in Bear Creek Cañon, which have been extensively developed by several miles of tunnels and drifts. Recently diamond drilling showed the ore bed to extend westward below the grade of the cañon, and a shaft was started to cut it at 700 ft., but at about 300 ft. the flow of water was so strong that shaft sinking was for the time suspended and an incline is being driven to reach the ore. The company is also mining from its claims near Saw Pit and shipping to the mill. It is reported that the capacity of the plant will soon be greatly enlarged again.

A Real Mining Revival is taking place in Boulder County. Prospectors and miners are reaping a harvest after several years of very "slim pickings." Attractive prices for tungsten ore have led to the opening up of many prospects that were located for gold and now are found to carry appreciable amounts of the black metal. In some instances, tungsten was known to occur in these properties, but was not developed commercially. It is now believed that the presence of tungsten in some of the gold ores of this county has been responsible for the low concentration accomplished and that much of the concentrate shipped for years may have been more valuable for its unrecognized tungsten content than for its gold. The heretofore recognized tungsten area tributary to the town of Nederland has been found to have competition in an area to the northeast of that town nearer the city of Boulder. The Boulder County Metal Mining Association is arranging an excursion from Denver to Nederland to give curious persons opportunity to witness the mining of tungsten.

SALT LAKE CITY—Oct. 22

The Old Dump at the Horn Silver Mine at Frisco, estimated to contain 175,000 to 200,000 tons of tailings, is to be utilized. The Caldo Mining Co., backed by Eastern capital, was formed a short time ago to take over a lease on the dump, and finance the building of a mill of 200 tons daily capacity. Construction is in the hands of the General Engineering Co., of Salt Lake, which also has charge of the management of the property. The principal value of the tailings is in silver, with some zinc. It is hoped to have the mill completed before the end of November.

Progress Is Being Made in the Construction of the Tintic Milling Co.'s new plant at Silver City. Foundations, retaining walls, and floors of the mill are completed, the bins are almost finished, and the steel work is being erected. The crushers and rolls are in place. There are to be three Holt-Dern roasters of 45-ton capacity, of the same type as used in the mill of the Mines Operating Co., at Park City, and one Christensen roaster, which was intended for the Knight mill, at Silver City, destroyed by fire not long ago. The cost of the mill will be about $150,000. The company has taken a lease on the old Eureka mill dumps, and on other dumps and low-grade ore in the district. Sixty-five men are employed on construction, and it is hoped to have the plant in operation soon after the first of the year.

The Facilities for the Treatment of Low-Grade Ore and dumps long idle, have been much increased by new reduction mills and flotation plants recently constructed or still in the process of construction. In some cases companies have been organized with a view to utilizing dumps at individual mines, and in others custom milling plants have been established. Also individual mines like the Utah Apex at Bingham, the Daly-Judge and Silver King Coalition at Park City have added or are adding flotation plants to their milling equipment. The Big Four Leasing Co.'s mill, at Atkinson in the Park City district, has been in operation for several weeks on tailings accumulated below the town, from the various mines of the camp; the capacity is 200 to 300 tons. The Broadwater mill—500 tons—also in Park City, backed by San Francisco capital, began work on tailings on the Homer ranch, which tailings it has under lease. Other new plants are the Utah Leasing Co.'s mill at Newhouse to retreat tailings from the Cactus mine, and the Caldo mill at Frisco to treat dumps from the Horn Silver. The flotation plants added to the mills of the Daly-Judge and Silver King Coalition are being rapidly completed. There has been an increase in milling capacity at the Daly-Judge of 50 tons a day; at the Silver King Coalition of 100 tons; and at the Utah Apex, an increase of 225 tons. The first mills mentioned are using the Callow flotation system, and at the Utah Apex the Janney system is in use. At the Apex mill there are 12 cells treating

150 tons of slimes a day. This plant is in the main mill building where the vanners used to stand, and has replaced the vanners. The concentrator of the United States Smelting Co., at Midvale, has been remodeled and enlarged from 350 to 600 tons daily capacity, and the capacity of the Huff electrostatic plant increased from 60 to 100 tons.

SEATTLE—Oct. 20

The Tolovana Paystreak has been definitely located on at least seven claims along the third tier bench of Livengood Creek counting every 20 acres as a claim. Counting No. 10, second tier, pay has been located on eight claims all told. However, all of the prospectors working from 2 Above to 10 Above, on the third tier, are in pay dirt which goes from $1.25 to $1.50 to the square foot of bedrock. The paystreak is 150 ft. wide in places, although in others it is not more than 60 ft. Its width on all claims, however, yet remains to be determined. Several diamond drills have been brought into the district by the operators, to prospect their ground during the winter, when it is believed many new paystreaks will be uncovered. Portions of the Circle City, Fairbanks and Rampart districts have now been combined to form the Tolovana Recording District which has its own recording office.

Valdez Mines Are Busy taking out ore and from present indications this winter will be the most active in the history of the camp. As rapidly as possible the Cameron-Johnson mine is being made ready for reopening. The veins on these claims ran into a fault and were lost, necessitating the closing down of the property, but the hot weather of last summer shrunk the adjoining glacier to a depth of 100 ft. and exposed the reefs on the other side of the fault. The Granite mine is busier now than at any time since it was opened, and the mill is running steadily. The vein has been cut in a lower level, about 500 ft. below the present workings. An up-raise is being driven to drain the water from the upper levels and there is sufficient ore in sight to keep the plant running for several years. The Cliff mine which has been operating for some time has been closed down pending the adjudication of some suits filed against "Red" Ellis, the owner. The Ramsay-Rutherford, however, is sending bullion to Valdez every two weeks and the operators have plenty of high-grade ore blocked out. The Valdez Mining Co. is doing considerable development work and Jack Miller took out about $50,000 from the State Creek placer diggings this summer. The Midas copper mine owned by the Granby company is now in much better ore and is filling the bunkers preparatory to shipping. Mark Tatum, the discoverer of the Granite mine, has discovered a body of magnetite on Valdez Bay. The ledge, which is wide, has been traced on the surface for a distance of about 800 ft. and in many places gave assay returns of more than $35 to the ton.

HIBBING, MINN.—Oct. 23

Mesabi Going Dry Is a Probability. It is reported that the Indiana Bureau is about to enforce the Indian treaty of 1855, closing the 60 saloons in Hibbing and 20 in Chisholm. The report has received no official confirmation. All saloons on the Cuyuna Range have already been closed, as well as many towns on the Western Mesabi, including Coleraine and Bovey. Operators express great satisfaction at the change from wet to dry.

LUNING, NEV.—Oct. 21

Optimism in the Santa Fé Mining District, Nevada, is fostered by all the developments during the last few months. The Calavada Mining Co. completed the cutting of a station at the 1,000-ft. level during the past week and are now crosscutting to the ledge. This property is controlled by the Giroux interests and will, on installing a new cable, sink to water which they expect to strike at about 1,200 ft. Arrangements are completed for the financing of the Luning-Idaho Mining Co., and work will be started on a large scale early in November with the purpose of fully developing the orebodies which have been exposed in several places. This property lies in the belt containing the Fermina holdings now being extensively leased. The Calavada or Giroux property and the Duffy mines were recently purchased from J. N. Bealer and associates. The New York Cañon section is a regular shipper, over 40 tons daily going out from the many leasers working there. All of this ore is high-grade copper. It must run more than 6% copper to pay the hauling, freight and smelting charges. It illustrates the possibilities of this district, when one stops to figure the tonnage of low-grade copper that is left on these dumps for future treatment. The Nevada Gold Mines Co., Ltd., operating on an extensive plan, southwest of town, is in some exceptionally high-grade gold-silver ore and has made all arrangements for a steady production this fall. R. B. Todd has arranged with eastern parties for the formation of a company to take over the Luning Gold Mines Co., and work will commence there in the near future. This property has been a good producer and has a large tonnage of milling ore blocked out. The development work at the Alameda Mines Co.'s ground is going steadily forward and with its large tonnage of low-grade copper it is rumored that a leaching plant will be installed at its camp in the near future. The fact that there are 20 sets of leasers working copper properties at a profit here, shipping in most instances copper around 5 to 10% speaks well for the camp. The starting of the leaching plant at the Nevada Douglas at Ludwig where this ore will eventually be shipped is expected to start a considerable development and mining boom here.

DOUGLAS, ARIZ.—Oct. 19

Cananea is Still Operating, although railroad communication is interrupted both from Nogales and Naco. The road from Nogales is reported to be in bad shape after General Calles' retreat and that from six weeks' to two months' work will be required to put it in operating condition. Recent arrivals state that nine bridges have been destroyed. Conditions are quiet in Cananea, the town being occupied by General Beltram with 150 Villistas, while to the south General Urbalejo is in authority with his band of Yaquis, who have been Villa adherents, but who may now take upon themselves "the supreme power" in all that part of Sonora which they can command. Naco and Nogales are in the hands of Carranzistas, so that together with the railroad service being out of commission, it may be necessary to stop operations at Cananea for lack of fuel, food and supplies. It is said that enough fuel and supplies are on hand to continue operations for two weeks, after which time a shutdown is inevitable, unless the railroad can be used and freight allowed to move southward before the expiration of that time. No disturbances have lately been reported from Cananea that in any way affected the operations of the company, it being reported that peace has been made between the company and the two contending factions, as far as the company's operations are concerned, by paying export duty to both.

[Cananea was forced to suspend operations Oct. 25, on account of the cutting of the railroad line by the Yaqui Indians.—Editor.]

Reports from El Tigre have, up to within the last few days, been optimistic, the management stating that operations would be continued regardless of the approach of Villa's men and that their arrival in camp was not looked forward to with apprehension; that it was expected that no hindrance of operations or molestation of Americans would ensue from the occupation of El Tigre by Villistas. However, within the last few days reports have been persistent that operations will be stopped and the Americans will attempt to reach the border as best they may. News of a fire at the mines of the Transvaal company's mine near Cumpas reached here yesterday, the building, supposed to have been the hospital, was burned to the ground, but the fire was not of incendiary origin.

La Colorado Mine, it is reported, was entered by gambucinos after it was closed down and stripped of all high-grade ore. The Minneapolis Copper Co. has stopped operations; most of the Americans employed have reached the border. Trains are not running south from Agua Prieta over the Nacozari railroad, but no breaking of the line has occurred to date. Autocars are run almost every day over the line as far down as Nacozari, enabling the Moctezuma Copper Co. to keep in touch with the few men who did not elect to leave at the general exodus last week.

TORONTO—Oct. 22

A Strike of More than 2,000 Employees of the various mines in the asbestos district, Thetford, Quebec, was inaugurated this week. The strikers demanded that wages be returned to the scale that was in force before the war. They also ask that they be allowed to purchase their supplies at any place they wish instead of the company's stores. At the outbreak of war the asbestos market was demoralized to such an extent that the companies were having a hard time, and the employees agreed to cut in wages. Since that time, however, the market has become active, and the strikers now ask that the old scale of wages be put in force.

VICTORIA, B. C.—Oct. 19

The Trail Smeltery has handled 347,348 tons of ore so far this year. Of this production 288,000 tons came from Rossland. Nelson shipped 2,425 tons. East Kootenay shipped 20,018 tons, principally from the Sullivan mine, while Slocan and Ainsworth districts furnished 14,843 tons. The shipments from mines in the State of Washington to Trail amount to over 16,000 tons so far this year.

The Mining News

ALASKA

YUKON GOLD (Dawson)—Is reported to have purchased holdings of John Holmgren in Ruby district and will put dredge on ground this winter.

CORDOVA MINING AND DEVELOPMENT CO. (Port Wells)—New mill being installed at mine near Golden in Port Wells district. Tunnels being driven.

MIAMI COPPER (Seward)—It is reported that A. H. Case, representing the above company, is investigating the Parker-Herschell properties near Seward.

ALASKA JUNEAU (Juneau)—It is reported that Charles E. Bruff, who built Sheep Creek Mill of Alaska Gastineau Co., will shortly come north to start work on new Alaska Juneau mill.

JUALIN ALASKA MINES (Juneau)—More men being taken to work at this property and indications are that mine will soon resume full operations left off at start of the European war.

VALPARAISO MINE (Ketchikan)—Is working mill at Dolimi to capacity and is considering construction of an addition. Tunnel is now in distance of 700 ft. and is being driven an additional 100 ft. into ore to keep plant busy all winter.

MATANUSKA COAL AND COKE CO. (Seward)—J. H. Sears, James McCoy, and Roy D. Fonda have filed articles of incorporation for above company. Purpose of company will be to mine and sell coal from Matanuska field which will be tapped by Government railroad running in from Seward.

MOOSE PASS CLEANUP (Seward)—Ronan and James who few weeks ago bonded Moose Pass claims located during summer by Frank Skeen and J. W. Stevenson, recently ran 4½ tons of their quartz through an arrastre, recovering 80 oz. of gold from amalgam. Stamp mill will be erected on property next spring.

ARIZONA

Cochise County

BISBEE COPPER (Bisbee)—Organized to develop Winwood group of claims lying between Denn and Copper King, both proven ore areas and lying less than 1,800 ft. from Sacramento Hill. Campaign of churn drilling and other prospecting will be undertaken.

Gila County

INSPIRATION (Miami)—Mill is reported to be recovering 28 lb. of copper from ore assaying 1.7%, and is treating 5,000 tons per day. Both recovery and operations said to be fully up to expectations of company.

ARKANSAS

Newton County

ARKANSAS MINING DEVELOPMENT CO. (Little Rock)—Filed articles of incorporation, $100,000 capitalization, to operate in northern Arkansas zinc fields. Will begin operation at Spear mine in Newton County. Company has also leased properties in Marion County and will develop any other mineral deposits in state which can be profitably secured. Company will own no properties but will develop them on lease or royalty basis. John T. Fuller is president and general manager.

CALIFORNIA

Alameda County

RED MOUNTAIN (Livermore)—Third calcining kiln being installed at this magnesite mine. Brick for structure is being hauled from Pleasanton by three-wheel traction engine. Brick for kiln lining from Livermore Firebrick Co. was hauled by same engine. Traction engine will also be used in building new road to another magnesite deposit 2 mi. from the Red Mountain.

Amador County

PINE GROVE MINING CO. (Pine Grove)—Sold 125,000 shares at 25c. per share under permit of corporation commission and granted permission to sell an additional 100,000 shares at the same price.

SUTTER CREEK MINING CO. (Sacramento)—New incorporation with capital stock at $300,000, to operate East Eureka mine at Sutter Creek. Directors are Alexander Rennie, M. A. Nurse, J. R. Farrington, J. J. White, of Sacramento and Lee Shirars, of San Francisco.

PLYMOUTH CONSOLIDATED (Plymouth)—Preliminary statement of production and costs in month of September shows 10,800 tons of ore milled; total value $53,076; total working costs, $30,302; development cost, $411. Surplus over total costs, $22,363. Additional expenditures, $250. James F. Parks is superintendent.

Butte County

FORBESTOWN district is advancing both in development and prospecting. District lies chiefly in Butte County but extends into Yuba County. Development is progressing at Gold Bank, South Banner and Solano Wonder. Activity extends from Forbestown west to Morris Ravine about 3 mi. north of Oroville.

ORO ELECTRIC (Oroville)—Purchase of this corporation by Great Western Power Co. reported to include only public-service department. Dredging department will be continued as formerly.

VILORO (Oroville)—Gold dredge No. 2 destroyed by fire Oct. 19. Fire caused by electric short circuit in transformers. Dredge had been run 7 days since last cleanup and contained a large amount of gold on tables. After burning to water's edge, hull sunk. Total loss. Viloro Syndicate Ltd., owner.

Calaveras County

MOKELUMNE HILL district is being developed and prospected actively. Recent interest is due partly to sale by Frank J. Woodward to Harry Bridge of mines and claims known as La Fortuna, Colorado, Ben Hur and other properties including dam, water ditch and flume and rights of way.

Eldorado County

RAILROAD SURVEY from Diamond Springs to Ringgold section in progress. Purpose of road is hauling lime and lime rock from deposits on 380 acres owned by Mrs. E. J. Edick, Dr. W. W. Stone and National Surety Co. Property was formerly owned by W. J. Dingee and under bond to California-Portland Cement Co. Development depends upon construction of this spur track. Much of limestone is said to be well adapted to manufacture of cement.

SACRAMENTO VALLEY COPPER (Sacramento)—Deeds from Thomas G. Patton have been recorded, conveying title to mining claims and property in Greenwood district. These are: Copper Princess, Dundee No. 2, Shamrock No. 2, Brown Bear and 17 other claims.

Imperial County

OIL DISCOVERY reported west of Salton Sea by M. V. Dutcher, of Imperial. Oil was found seeping from slight anticline on floor of desert. Three hours digging produced about 20 gal. of heavy oil. Whether prospect is sufficient to encourage development is not stated. State Mining Bureau states that according to opinion of Dr. F. J. H. Merrill, Miocene beds in this region are not especially favorable to oil formation.

Nevada County

BRUNSWICK CONSOLIDATED (Grass Valley)—Expected that new 20-stamp mill, electrically driven, will go into commission within few days.

UNION HILL (Grass Valley)—John E. Pelton and associates reported to have acquired control and arrangements being made for extensive development. Shaft will be deepened to 1,000 ft. On 800 level orebody continues with development. The 20-stamp mill is crushing ore from this level. The cleanup Sept. 1 was $6,800; Sept. 15, $5,600, a total of $12,500 for 30 days' run. New directors recently elected John E. Pelton, Daniel E. Craig, E. W. Knowlton, of Pasadena, Otto B. Johnson, of San Francisco; G. S. Johnson, of Reno.

San Luis Obispo County

KLAU (San Luis Obispo)—This quicksilver mine reported producing 30 flasks a month. Mine has been idle for three or four years following destruction of furnace by storm and fire.

Siskiyou County

KANGAROO GULCH is proving to be one of richest quartz districts developed in County for several years. Joe Davidson and Sam Sargent have recently developed ledge about 4 ft. wide, carrying ore worth $3 to $5 per ton. Claim is an old one which has been developed for several years in small way.

Stanislaus County

DRILLING FOR OIL at Knights Ferry has been resumed after suspension resulting from breakage of machinery. Well is down 160 ft. and it is reported that first oil sand has been passed. Probable that second oil sand will be reached within 2,000 ft.

Tulare County

PORTERVILLE MAGNESITE CO., (Porterville)—Two cars crude magnesite shipped in last week of September. Foundations for calcining kiln have been constructed and when plant is completed ore will be treated at mine. Survey made for spur track from Southern Pacific R.R., to base of magnesite hill.

RAWHIDE (Jamestown)—Reported that property has been sold to Silver Peak Mining Co., of Blair, Nev., and that company will move its surface plant from its mine in Nevada to Rawhide. John Mocine formerly secretary of California Metal Producers Association is engaged as superintendent. Stated that 3-compartment shaft will be immediately unwatered and retimbered where necessary. The shaft has an incline depth of 1,800 ft. This is one of producing mines owned and operated by Capt. Nevills and taken over by Patterson Estate of Fresno County following death of Nevills. Negotiation for sale of property was conducted by Alex Chalmers, manager of Lightner mine at Angels Camp, representing owners.

COLORADO

Clear Creek County

HOOSAC TUNNEL (Idaho Springs)—Company owning this property is being reorganized under permission from court in bankruptcy.

ONEIDA (Freeland)—Oneida-Stag mill is now equipped to treat ore by flotation, cyanidation having been discarded. Fifty tons of ore averaging $5.50 per ton are being concentrated daily at a ratio of about 12:1. Mine and mill employ 22 men.

GEORGETOWN TUNNEL (Georgetown)—Development will be resumed in this tunnel in Columbia Mt. within next 30

days. Georgetown Mining and Tunnel Co. contemplates early installation of electrically-driven equipment to advance tunnel several hundred feet.

SUN & MOON (Idaho Springs)—Development of this property has been undertaken by Von Tilborg Mining and Leasing Co. Particular attention will be paid to Garden vein east and west of Argo Tunnel on which drifting is in progress. A 2-ft. streak of payable ore has been opened carrying gold, silver, copper and lead. Nels Holme is superintendent.

COLORADO METAL MINING AND REDUCTION CO. (Georgetown)—Has been incorporated at $1,000,000, to take over properties of former concern organized to commercialize Malm dry-chlorination process. Proposes to revive operations in plant erected, several years ago, at Georgetown, and to reduce complex, low-grade ores of that region. Dr. Frank W. Traphagen, professor of metallurgy in Colorado School of Mines, is president of new company.

Gilpin County

PITTSBURG EXTENSION (Russell Gulch)—Fortune Mining and Milling Co. has been formed to operate this group of four claims adjacent to famous Pittsburg mine. New shafthouse contains electric hoist and air compressor. Development being pushed, with fine showing in Pittsburg vein.

Lake County

EVENING STAR (Leadville)—George E. Cramer is building new shafthouse at No. 5 shaft to replace one destroyed by fire a few weeks ago.

San Juan County

SILVER CROWN M. AND D. (Silverton)—New main tunnel, being advanced on Lee vein, has opened body of payable ore 8 ft. wide. About 3 ft. assays high in gold, silver and copper, balance of vein being milling ore. Experiments indicate that ore can be treated profitably by flotation process. James Burns is manager.

BALLARD (Telluride)—Leasers Anderson and Lacey have moved aërial tramway upper terminal from Ballard tunnel down to Butterfly crosscut which will hereafter be main mouth of mine. A block of ground above this adit, 300 ft. high and 600 ft. long, averages about $7.50 per ton. Mining and milling costs amount to $2.50 per ton.

Teller County

PORTLAND GOLD MINING (Victor)—Has acquired acreage along Wilson Creek, east of city of Victor, where it proposes to dispose of its tails from cyanide mill on top of Battle Mt. Sluice, more than mile long, is being constructed down slope of mountain.

IDAHO

Blaine County

WILBERT MINING (Arco)—Will pay initial dividend of $10,000 on Nov. 15. Stockholders have paid assessments of about $65,000. Mine, located in Dome mining district, is splendidly equipped with machinery, mill and railroad for transportation of ore from mine to mill. There are 16 patented claims, considerable reserve fund, and no debts. Ore is lead-silver and large tonnage has been blocked out.

Shoshone County

CŒUR D'ALENE GALENA (Kellogg)—This property is situated just above Caledonia, near Alhambra. Strike of 15 ft. of shipping ore is reported.

REX (Wallace)—Rex Consolidated Mining Co., controlled by New York people, is unwatering Rex mine preparatory to extensive development. Shaft down 700 ft. Probably require 30 days to unwater. Company has 250-ton mill, now rented to Tamarack & Custer.

OOM PAUL (Kellogg)—At meeting of directors held in Wallace Oct. 16 funds were provided and plans were made for continuing development work during winter. Enlarging of old Echo tunnel, through which Oom Paul is working, has been completed. To reach vein will require 3,000 ft. additional driving.

INTERSTATE-CALLAHAN (Wallace)—Aërial tramway connecting mill and railroad, 2 mi., is now in operation, eliminating wagon haul. Management estimates direct saving of $1 per ton. New boarding house to accommodate 70 men just completed and also 20 cottages for married employees. Ore blocked out for 4 years.

HYPOTHEEK (Pine Creek)—Contract has been let by this company to Riblet Tramway Co. of Spokane for 3½-mile tram to connect mine with proposed mill. Hypotheek vein is anomalous in that carbonate ore persists to depth of 1,100 ft., although sulphides are beginning to predominate at that depth. New mill will be designed to treat 200 tons of carbonate ore daily and will be remodelled later to treat sulphide ore; it will be built near the tracks of O.-W. R.R. & N. Co. short distance below Enaville.

INDEPENDENCE-GETTYSBURG (Mullan)—Independence Lead Mines Co., of which Stewart Mining Co. is the controlling factor, has begun extensive development of its recently acquired property lying between Morning and Hunter. In tunnels Nos. 2 and 3, on Gettysburg claim, 10 and 12 ft. of ore of fair milling grade have been opened, and tunnel on Independence also shows ore. Compressor will be installed at once at No. 4 tunnel and work will be continued in all tunnels during winter.

RAY-JEFFERSON (Wallace)—At meeting of directors held at Wallace recently details of arrangements for 250-ton mill and winter development were perfected. Construction of mill will start as soon as weather permits and management hopes to have it finished by July 15, 1916. Crosscut extended southward from No. 2 tunnel in search of big Interstate-Callahan zinc vein has cut two small zinc-lead veins but has not yet reached its objective. No. 2 tunnel is on original Callahan vein and face is nearing boundary line. Raise will be driven from No. 2 to No. 1, distance of 432 ft., in preparation for stoping operations; this oreshoot is about 900 ft. long. Leasers on Carlisle claim, owned by Ray-Jefferson, have three cars of lead and zinc ore sacked for shipment. They are driving another tunnel to tap Carlisle vein 200 ft. deeper, at point where it is expected to intersect Ray-Jefferson vein.

MICHIGAN

Copper

MOHAWK (Mohawk)—This year is going to break all records for output and for reduction of costs. Plans calculated to bring better results in 1916 are going forward with speed. At shaft farthest north, first concrete skipway has been laid. No. 4 shaft has been sunk to 22d level. No. 5 is cutting plat at 17th.

TAMARACK (Calumet)—Old Osceola amygdaloid lode, as handled by crosscut in No. 2 Tamarack, now is furnishing considerable tonnage of rock. It is not, of course, anywhere near as rich rock as Calumet conglomerate upon which Tamarack originally built its faith and hope, but it is better than average of Osceola lode.

AHMEEK (Ahmeek)—Is to resume sinking in No. 3 shaft soon. Sinking at No. 4 will start few months later. Ahmeek's costs, including construction, will be close to 8c. per lb. this year if present status is maintained. Copper return is 24 lb.; slight falling off from average of 1911 and 1912 when it ran above 25 lb., but better than 1914 when it was 23.

ISLE ROYALE (Houghton)—Ran into real problem in sinking through sand to get to bedrock at No. 7. Second of three shafts now is going down. This is necessary, to put permanent hoisting shaft in angle of lode. There has been decided betterment in lode-rock contents lately. Last month it ran better than 14 lb. refined.

COPPER RANGE CONS. (Painesdale)—In connection with improved milling methods, cheaper and better extraction and utilization of horsepower at Lake Superior mills, turbine plant at Baltic stamp mill has been in successful operation for period of over two years. At Champion mill at Freda turbine plant now is being installed. It is practically a duplicate of the one at Baltic. Power poles are being set up between mines and mills so that surplus of this power can be used. Construction work now is so well along that it can be called into service within a few months. Success of sand filling system underground long ago proven. More economical handling of sand has been brought about.

Iron

ATHENS (Negaunee)—Shaft now down about 900 ft. Cage hoist is soon to be discontinued and skip hoist installed. Both will be used when mine is operatng.

SALISBURY (Ishpeming)—Mining operations resumed this week. About 75 men employed for present. Drift has been run 2,600 ft. south from shaft. Raising is now in progress to tap new body of ore.

MINNESOTA

Duluth

MINNESOTA STEEL CO. (Duluth)—First coke was made in ovens on Oct. 20. Blast furnaces have been lined and will be started as soon as two necessary pieces of machinery arrive from East. First steel billets will be turned out on Nov. 10 if present plans do not miscarry. There are now 100,000 tons of coal and 120,000 tons of limestone in stock at plant. More is arriving daily. Merchant mill and other mills will not be ready for operation until next spring. However, there is a great demand for billets and they will be shipped East.

Cuyuna Range

CUYUNA-SULTANA (Ironton)—Soo Line trackage to property will be completed early in November. At company's concentrator it is claimed average of combined iron and manganese in product is 55% or over.

CRAFT (Crosby)—A 1/18 interest in original lease of 12c. per ton on this property was recently sold for $30,000, placing valuation of $540,000 on whole lease. Holders of this lease have re-leased to N. P. interests at 62c. per ton.

Mesabi Range

STEPHENSON (Hibbing)—Shovels started loading ore this week. First work done this year.

CROSBY (Nashwauk)—Washing plant, nearing completion, differs from others on the range in that each unit of machinery has its individual motor, avoiding necessity for shafting and belts.

TIOGA (Chisholm)—Sinking was started this week. Temporary frame buildings being erected. Work will be rushed, hoping to start mining in 1916. All machinery will be electrically operated.

MISSOURI—KANSAS

OLD VIRGINIA MINING CO. (Joplin, Mo.)—Formed with 100,000 shares $1 par value. J. F. Dexter principal owner. Has already secured several acres of valuable mining land which will be developed.

GOLDEN STANDARD (Galena, Kan.)—Lease near New Century ground will have new 200-ton mill. Will be one of most modern and best-equipped plants in district. Work on construction commenced; expect to have ready for operation within three months. This is fifth company to start mining on Wyandotte land.

ATHLETIC MINING AND SMELTING CO. (Duenweg, Mo.)—Will enlarge mill to 1,000 tons capacity per 24 hr. instead of 350 tons, formerly reported. Another compressor also to be installed and 300 hp. boilers. Will have also new slime plant, 21 James tables, 2 Dorr thickeners, Dorr classifier, and other improvements.

BRADLEY L. AND Z. CO. (Joplin, Mo.)—Found rich run of blende on lease near Chitwood. Has been driving blank drift toward drill hole which showed good run of ore; struck orebody first of week; expect to have it opened up within week or two so will be able to keep mill, recently repaired, going steadily. Two more tables being added and capacity increased to 250 tons per shift

SUPERIOR IRON AND FURNACE CO. (Iron Mountain, Mo.)—Old Iron Mountain tract of 1,700 acres has been bought by this company which proposes to reopen property and erect small charcoal furnace. Three charcoal furnaces were operated on this property about 40 years, which cleaned up oak timber for over 20 miles in every direction; second growth of oak is now sufficiently large for cutting.

MONTANA

Deer Lodge County

WASHOE REDUCTION WORKS (Anaconda)—Work was started Oct. 14 tearing out sixth section of concentrator preparatory to installing new system including flotation. Work is also progressing on building for additional flotation plant that will take care of slimes that cannot be handled in concentrator. New roaster building is going up rapidly. Sixteen of 28 furnaces, each 25 ft. in diameter are in place. One of them will be lined with cement instead of brick as an experiment. Furnaces are combination of McDougall and Wedge types, being water cooled instead of air cooled as is Wedge. Experimental zinc plant is operating satisfactorily and process promises to be great factor in development and exploitation of zinc resources in Montana. Experiments being made with coal-dust firing in furnaces of new leaching plant and if anticipations are realized system will be installed there.

Fergus County

BARNES-KING DEVELOPMENT (Kendall)—Has purchased all property of Kendall Gold Mining Co. in Fergus County for $100,000; $40,000 cash and remainder at $10,000 per month. Acquisition settles ore controversy existing between two companies.

Silver Bow County

BUTTE & SUPERIOR (Butte)—In September mine treated in its oil flotation plant, 37,278 tons of ore at cost of $3.19 per ton, recovering 8,968 tons of concentrate, valued at $81.50 per ton.

NORTH BUTTE (Butte)—Under new compensation law in effect in Montana, accident of Oct. 19 will cost North Butte company between $75,000 and $85,000 in pensions to be paid to relatives of dead men and to injured men themselves.

ELM ORLU (Butte)—Announcement made that contract will be let for new hoist and other improvements, to approximate total expenditure of $125,000. Hoist will be similar to that at Granite Mountain shaft of North Butte. Will have capacity for depth of 4,000 ft.

TUOLUMNE (Butte)—Output to be increased from 100 to 150 tons per day. Principal operations now being carried on on 2,000-ft. level. Orebody on 2,500-ft. level is 4 ft. in width; average copper content 4.6% with about 1 oz. of silver for every per cent. of copper. Among recent improvements are trams to convey lumber and fuel from railroad tracks to workings. Has 100 men on payroll. Ore being shipped averages 4% copper with considerable silver and small amount of gold.

EAST BUTTE (Butte)—The 800-ton flotation plant is practically ready for operation. Process is similar to that employed at Butte & Superior. Plant will treat all second-class ore and tailings from old processes which carry 14 to 16 lb. of copper to the ton. By flotation, loss in tailings will be reduced to about 4 lb. per ton. East Butte is mining about 900 tons of ore per day, of which 300 tons are first and 600 tons are second class. In addition to this it is handling Butte-Alex Scott ore.

NEVADA

Esmeralda County

SILVER PICK CONSOLIDATED (Goldfield)—Station completed on 600 level and east crosscut started to intersect vein encountered on 700-ft. level. Continuing north drift on 500 level on Phelan Vein.

JUMBO EXTENSION (Goldfield)—Dividend No. 5 of 10c. share declared by recent directors' meeting, payable Dec. 31, will leave surplus of $200,000 in treasury. Estimated production for September, 2,900 tons; gross value, $102,000. Net profit, $52,000.

SPEARHEAD (Goldfield)—After about eight years' inactivity, excepting leases, work is to be resumed on company account. Shaft to be continued from present depth of 250 ft. to 950-ft. point to cut latite-shale contact. Expect to intersect Wheeler ledge at 550 ft.

GOLDFIELD MERGER MINES CO. (Goldfield) — From latite shale contact drift, which was run at a vertical depth of about 1,200 ft., northeast crosscut has been started to intersect downward extension of Jumbo Extension orebody.

DIAMONDFIELD BLACK BUTTE REORGANIZED MINING (Goldfield) — Operations at main shaft temporarily suspended. Company will participate in Marine Lease on company ground which is extracting ore. Compressor and drills will be installed.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 16 amounted to 9,761 tons, estimated at $201,658, compared with 9,583 tons last week. Producers were: Tonopah Belmont, 2,899 tons; Tonopah Mining, 2,800; Tonopah Extension, 1,850; West End, 672; Jim Butler, 1,100, and miscellaneous leasers, 440 tons.

TONOPAH BELMONT (Tonopah)—Net profit for September was $65,018 from 12,008 dry tons milled.

TONOPAH MINING (Tonopah)—Net profit for September was $51,720 from 12,057 dry tons milled; average value, $12.04 per ton.

JIM BUTLER (Tonopah)—Net profit for September, $22,232. Falling off from August, due largely to greater tonnage of low-grade ore from development.

WHITE CAPS (Manhattan)—Delinquent stock sale held in Tonopah, Oct. 16. There were 136,000 shares sold at price ranging from cost of assessment, 1½c. per share, to over 5c. per share. Practically all the stock was purchased by local investors who appear to have considerable faith in future of company. Developments in connection with future operation of White Caps, especially in connection with installation of adequate milling plant, are expected in near future.

Storey County

SIERRA NEVADA (Virginia)—On 2,500 level west crosscut at 35-ft. point exposed quartz in bottom of face assaying $11 per ton.

BELCHER-CROWN POINT (Gold Hill)—Saved 37 cars of mill rock from stopes in 1,300 Belcher raise. Jacket mill received 1,077 tons of dump rock and shipped one bar of bullion.

MEXICAN (Virginia)—Southwest drift from No. 3 on 2,500 level at 38-ft. point shows 3 to 4 ft. of low-grade quartz. No work done on 2,700 level owing to trouble at C. & C. shaft. Mill crushed 300 tons of ore, averaging $13.09 per ton.

CON. VIRGINIA AND OPHIR (Virginia)—Joint west crosscut from winze on 2,700 level reached 16-ft. point; face in porphyry. On Ophir 2,500 level, winze deepened to 15-ft. point. Saved 8 cars of ore averaging $7.80 per ton. Central tunnel north crosscut extended 5 ft. Saved 315 cars from stopes and development; milled 220 tons.

UNION CON. (Virginia)—Saved 83 cars of ore from north lateral drift stope on 2,500 level; assayed $49 per ton; last 35 cars averaged $63 per ton. In No. 1 raise, north drift advanced 4 ft. with face in ore averaging $50 per ton. East crosscut also started in hanging-wall side advanced 4 ft. with face assaying $30 per ton; 12 ft. across top at north end assays $50 per ton. Center and south end is in good milling ore.

NORTH CAROLINA

Stanly County

SOUTHERN ALUMINIUM CO. (Whitney)—Plans are under way for resumption of work on plant, about three-fourths completed, which was suspended at outbreak of European War. French interests known as L'Aluminium Francaise are in control of property in which is associated American Metal Co. Probable cost of plant on completion will be nearly $10,000,000.

UTAH

Beaver County

MOSCOW (Milford)—Deposit of zinc ore, much of it high grade, recently discovered on 200 level of old workings, is 10 to 15 ft. in width, and there are 150 ft. of backs. There is said to be about $100,000 worth of ore, and shipments are expected at rate of one car daily. New electric hoist is being installed on 600 level at Cullen shaft which will be sunk to 1,100.

Juab County

TINTIC ORE PRODUCTION for week ended Oct. 16 amounted to 124 carloads, estimated at 6,200 tons, valued at $155,000, compared with 137 carloads week previous.

Salt Lake County

ALBION MINING (Alta)—Lessees operating in old workings have made strike of good ore, and will continue work throughout winter. Eighteen men are working. Development is being done through Quincy tunnel of South Hecla.

Summit County

PARK CITY ORE PRODUCTION for week ended Oct. 16 amounted to 1,614 tons, valued at $64,000, compared with 1,498 tons week previous.

DALY-JUDGE (Park City)—Raise 200 ft. from 1,200 level has opened high-grade ore, which, it is expected, will make along contact, and develop into deposit such as found in other parts of property. Construction work on addition to mill, which is to contain Callow flotation plant has been cmpleted, and machinery is being installed.

SILVER KING COALITION (Park City)—Shipments are being made at rate of 550 to 750 tons of ore and concentrates weekly, ore coming from 1,450 level and above. Some unusually rich ore is being mined. Eight cars, recently shipped, are reported to have assayed 84 oz. silver, 35% lead, with considerable zinc.

Tooele County

BULLION COALITION (Stockton)—Work is being continued on station at 200-ft. level below Honerine tunnel, where pumps are to be installed. All of ore produced by this property is taken out through this tunnel, which also supplies water for irrigation.

CANADA

British Columbia

BRITISH COLUMBIA COPPER (Greenwood)—September profits reported $10,000. Only one of three furnaces at smeltery in operation. This averaged 800 tons of ore per day. Development work on newly acquired Copper Mountain property continues, but production has not started.

Ontario

CONIAGAS (Cobalt)—This company has passed the dividend due Nov. 1 reason assigned being that company has limited its output on account of low price of silver.

CROWN-RESERVE (Cobalt) — This company has taken charge of Globe Consolidated mine in Trinity County, Calif. It agrees to spend $50,000 at rate of $4,000 per month to be repaid out of gross ore receipts. After all debts are liquidated Globe Consolidated will give Crown-Reserve a 55% control on 30-year lease.

MEXICO

Sonora

GREENE CANANEA (Cananea)—Closed down Oct. 25 as result of destruction, by Yaquis, of several bridges on line between Cananea and Naco, on American border, Cananea's port of entry. It is understood that no violence has been done to property, and officials of company do not expect any. Shutdown is made necessary to conserve supplies of oil at plant in order to keep pumps and other necessary machinery running.

SOUTH AMERICA

Peru

CERRO DE PASCO MINING CO. (Lima)—Will be reorganized through formation of new company with 1,000,000 shares, without par value. New company will issue $10,000,000 convertible 6% 10-year bonds which will be bought by J. P. Morgan & Co. Of capital stock, 333,333 shares will be reserved for converting bonds after two years and up to 10 years at $30.

The Market Report

Metal Markets

NEW YORK—Oct. 27

All of the principal metals were stronger during the last week and a good business was done in each case.

The average prices for the metals in October will be reported on Nov. 3, Wednesday.

Copper, Tin, Lead and Zinc

Copper—A good business was done both with domestic and foreign buyers. By Saturday the market had advanced so that 18c., regular terms, was realized. Some of the larger producers who had previously stood aloof in the domestic market, nominally asking 18¼c., regular terms, met buyers and made sales at 18c. The Lake producers were reported as having made excellent sales at 18c. At the close the market stood at 17.90@18c., regular terms (17.70@17.80, cash, New York), most of the producers asking 18c., but being willing to make small concessions for desirable orders.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 18½@19c. per lb. at mill.

Copper Imports in the United States, week ended Oct. 9, are reported by the Department at 4,208,016 lb. metal and 426,799 lb. in ore and matte; total, 4,634,815 lb. Chief imports were from Peru, Chile and Canada. The exports for the week were 4,335,622 lb. copper; of which 2,543,102 lb. went to England and 1,412,234 lb. to Italy.

Tin—This market was steady, a fair business being reported done.

Lead—On Oct. 21 the A. S. & R. Co. advanced its price to 4.75c., and since then the market in New York has been steady at that figure. This advance was foreshadowed by the narrowness of the margin between the New York and St. Louis prices. Following the advance, the margin has continued narrow. Certain favorite brands of Missouri lead that are especially sought for the manufacture of sheet lead for sulphuric-acid chambers are temporarily unavailable, the producers being completely sold out for a month or six weeks ahead. All of the principal producers report a good business in lead being done during the last week.

Spelter—A large business was done during our last week of record, the total of sales being without any doubt in excess of 12,000 tons. Business was done chiefly with foreign buyers, especially for export to France. In the main it was done in contracts for deliveries running far ahead. These varied from contracts covering the first quarter of 1916, to contracts beginning immediately and running through the first quarter of 1916, and even further. For example, there was one very large sale covering deliveries November-June. With respect to the prices realized, conditions were rather erratic. Spelter for prompt delivery sold as high as 14c. in the latter part of the week, while the market for November at the close was about 13½c., for December, about 13c., and for January, about 12½c. Large contracts covering different periods realized a great variety of prices. The average of a little upward of 7,000 tons reported to us as sales for the week was about 12 cents.

Domestic consumers were again conspicuous by their absence. Nor was there any demand worth mentioning for spelter for early delivery. On the other hand there was no pressure to sell it. There seems to be plenty available but those who have it prefer to sell it only in conjunction with metal for later delivery.

The market for high grade and high-grade intermediate spelter is developing into an interesting situation. The supply of this is increasing but some of the producers find it difficult to sell it for the prices they think due them and are holding back their supplies until buyers become more generous. In the meanwhile the producers of these grades of spelter are increasing in number.

High-grade spelter is being offered by a new company, the American Spelter Corporation, 61 Broadway, New York. This company, in which George E. Nicholson is interested, has built a smelting plant at Kusa, Okla., near the new plant of Mr. Nicholson. The supposition is that it will refine by redistillation some of the common spelter produced by Mr. Nicholson.

The American Zinc, Lead and Smelting Co. is now producing high-grade intermediate spelter almost to the exclusion of common spelter.

The Owen Spelter Co. is building a 640-retort plant at Caney, Kan. Expected to be in operation in December.

Some of the recent demand for spelter for prompt delivery has been from new smelters who expected to be making spelter at this time, but have been delayed and have had to buy in order to fill contracts for delivery that they had entered into.

The American Zinc, Lead and Smelting Co. has opened a New York office in the Equitable Building, 120 Broadway. Charles W. Baker, a director of the company, is in charge.

Zinc Sheets—Business has been active, sales good but with no material change in quotations. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Oct.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			17.55			4.62½	11.50
21	4.6700	49	@17.65	33¼	4.75	@4.67½	@13.50
			17.60			4.62½	11.50
22	4.6538	49	@17.70	33¼	4.75	@4.67½	@13.50
			17.60			4.62½	11.50
23	4.6350	48¾	@17.80	33¼	4.75	@4.67½	@14.00
			17.60			4.65	11.50
25	4.6200	48¾	@17.80	33¼	4.75	@4.67½	@14.00
			17.70			4.65	12.00
26	4.6200	48¾	@17.80	33¼	4.75	@4.67½	@14.00
			17.70			4.65	12.00
27	4.6100	48¾	@17.80	33¼	4.75	@4.67½	@14.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Oct.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
21	23⅞	72⅛	73⅛	86	18.35	151⅛	153⅛	24 7/16	5.07	63½	13.22
22	23 11/16	73⅛	73⅛	88	18.29	151⅛	153	24 7/16	5.02	66½	13.84
23	23⅞	.....	.....	.....	.....	.....	....	.....	.....	....	....
25	23 11/16	72⅛	72⅛	88	18.16	153⅛	154⅛	24⅜	5.03	69½	14.35
26	23 11/16	72⅛	72⅛	88	18.16	154⅛	154⅛	24 7/16	5.05	68½	14.14
27	24	72⅛	72⅛	88	18.12	154⅛	154⅛	24⅛	5.00	68½	14.11

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Other Metals

NEW YORK—Oct. 27

Aluminum—Market conditions remain about the same. Stocks of imported metal are low and the chief domestic producer has none to offer for early delivery. Quotations are 53@56c. per lb. for No. 1 ingots, New York.

The action of the stockholders of the Southern Aluminium Co. is referred to on another page.

Antimony—The market has been strong and active and prices have advanced sharply. Sales have been good on the rise, and the tendency at the close is upward. Chinese and other ordinary brands are quoted at 35@36c. per lb. Cookson's, in which there is little doing, is held at 45@46c. per lb., New York.

Nickel—Quotations for ordinary forms are nominally 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—Stocks continue scarce and the market is strong and advancing. New York quotations are $95 per flask of 75 lb. for large lots and $95@97 for smaller orders. A considerable shipment from California is reported held up in the Panama Canal. San Francisco reports by telegraph a brisk, strong market, with quotations $90@93 per flask. London price has been advanced 10s. and is now £16 per flask; no discount reported from second hands.

Gold, Silver and Platinum

NEW YORK—Oct. 27

Gold and Silver Movement in the United States, nine months ended Sept. 30, as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$157,656,778	$12,936,680	$38,480,444	$35,557,483
Imports	39,941,946	265,871,213	17,791,486	25,276,972
Excess	E.$117,714,832	I. $252,934,533	E. $20,688,958	E. $10,280,517

Exports of merchandise in 1915 are valued by the Department at $2,529,575,095; imports, $1,302,281,591; excess of exports, $1,227,293,504. Adding the gold and silver gives $984,639,488 as the net export balance.

Platinum—Conditions remain about the same and no additional supplies seem to be in sight. Prices are a little uncertain, and higher rates may be asked. For the present, however, they remain at $50@55 per oz. for refined platinum and $55@60 per oz. for hard metal.

Our Russian correspondent writes under date of Sept. 24 that speculative interest in the market has decreased, owing principally to the increased difficulties imposed by the government to the export of platinum. Prices have fallen, though they still fluctuate considerably. Current quotations at Ekaterinburg for crude metal, 83% platinum, are 10@10.30 rubles per zolotnik; at Petrograd 38,000@39,000 rubles per pood—equal to $38.16 and $37.73 per oz., averages.

Iridium—This metal continues in demand and at a high price. Nominally $80@85 per oz. is quoted, but all sales are the result of negotiation and it is impossible to fix prices definitely.

Silver—Price has been maintained in London chiefly by purchases for home coinage and continental inquiry. But while the London price has advanced, the New York price has not quite held its own, owing to the decline in the rates of foreign exchange.

Imports of silver into Great Britain, nine months ended Sept. 30, were £7,178,943; exports, £5,713,480; excess of imports, £1,465,463, which compares with an excess of exports of £117,085 last year.

Zinc and Lead Ore Markets

JOPLIN, MO.—Oct. 23

Blende, high price $87.50; base per ton of 60% zinc, premium ore, $85; medium grades, $83@78; lower grades, $75@70; calamine base per ton of 40% zinc, car lots, $55@60; average selling price, all grades of zinc, $81.04 per ton. Lead, high price $56; base per ton of 80% metal content, $50@55; average all grades of lead, $50.87 per ton.

SHIPMENTS, WEEK ENDED OCT. 23

	Blende	Calamine	Lead	Values
Totals this week.	12,244,350	942,250	1,552,950	$564,910
Totals this year..	469,530,190	35,168,430	73,035,260	20,700,840

Blende value, the week, $496,160; 43 weeks, $17,975,690.

Calamine value, the week, $29,270; 43 weeks, $812,340.

Lead value, the week, $39,480; 43 weeks, $1,912,860.

Lead prices, which sagged to around $50 base a week ago, closed tonight strong at $55. The blende market continued strong for premium ore; other grades weakened by midweek and found ready buyers at the week-end on the lower price level. The United States Smelting, Refining and Mining Co., which has been out of the market several weeks, was an active week-end buyer in the Miami camp at advanced prices.

Three weeks of excellent weather is creating a marked improvement in the production of blende and calamine, and the buying is strong enough to take up the production.

PLATTEVILLE, WIS.—Oct. 23

The base price paid this week for zinc ore was $75@72 per ton for 60% grades. The base price paid for 80% lead ore was $54 per ton.

SHIPMENTS, WEEK ENDED OCT. 23

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,584,180	406,300	530,920
Year	162,826,760	5,683,210	22,238,770

Shipped during week to separating plants, 4,669,460 lb. zinc ore

Iron Trade Review

NEW YORK—Oct. 27

The demand for finished steel continues strong and improving, domestic orders supplementing the export business. The mills are so full that deliveries are becoming uncertain.

Car orders, bridge orders and structural work are increasing rapidly, and contracts for material are now running well into and even over the first quarter of next year.

A buying movement in pig iron seems to have set in. Some large orders for basic pig have been placed or are on the market, and there are more inquiries for foundry iron. Recent advances in price are well held and more are in sight.

Exports from Baltimore for the past week included 380,885 lb. tinplates to London.

The stockholders of the Thomas Iron Co. have been notified that an offer has been made for their property and they will be asked to vote on giving an option.

The United States Steel Corporation in its preliminary report for the quarter ended Sept. 30 shows net earnings, after deducting operating expenses, ordinary repairs and renewals, as follows:

	1914	1915
July	$7,475,973	$12,048,218
August	7,584,926	12,869,099
September	7,215,083	13,793,327
Quarter	$22,276,002	$38,710,644
Depreciation and subsidiary charges		$8,664,853
Bond interest and sinking fund		5,703,631
Dividend on preferred stock		6,304,919
Total charges		$20,673,403
Surplus for the quarter		$18,037,241

For the nine months ended Sept. 30 the total net earnings were $60,727,979 in 1914 and $79,118,908 in 1915, an increase of $18,390,929. The September quarter this year showed a gain of $10,760,589 over the June quarter. The surplus for the quarter was equal to 3.5% on the common stock, but no dividend on that stock was declared, and no appropriations for new work were made.

PITTSBURGH—Oct. 26

Yesterday the Carnegie Steel Co. advanced bars, plates and shapes $1 a ton to 1.50c., Pittsburgh, just 10 days after its previous advance, and making $3 a ton advance in these products in less than a month. The 1.50c. price seems to be minimum for all the mills, but none will sell freely and some are practically out of the market. It is estimated that with the utmost reserve in accepting additional orders the mills will end the year with fully six months of obligations on books. Sheets are advancing, for delivery at mill convenience, and the leading interest is on the verge of opening its books for first-quarter contracts, at prices well above those now ruling for delivery at mill convenience.

In all finished steel products the pressure to buy has been steadily increasing, partly because prices promise to advance still more sharply in future, and partly because consumptive requirements are increasing. The railroads are faced with a car shortage not merely during the crop moving period, but afterwards, and there is inquiry in the market that may result in the placing of 40,000 to 60,000 freight cars in the next few weeks. Rail orders to date total about 550,000 tons. Car-repair material is in great demand and premiums for prompt shipment have been paid on a large tonnage altogether. The requirements of various domestic consumers are increasing, while the war demand continues very heavy and the demand from neutral countries shows further expansion. Since the mills have already been producing all the steel of which they are capable, and yet have been falling behind in

deliveries, the common prediction is that there will shortly be a veritable famine in steel.

Finished steel prices are now as high as they were at the top of the great movement of 1912, and are still advancing, more rapidly indeed than earlier in this movement. For a few finished-steel products premiums are offered for early delivery, but there is not much demand of this sort thus far, as buyers are well covered by contracts, as a rule. Since contracts are now being made in very conservative fashion by the mills there will probably be much more premium business going on in the market a few months hence. The small mills generally avoid contracts and will have steel to sell when the large mills are filled up tight for deliveries severa months ahead.

Pig Iron—All the furnaces that were quoting $14.50, Valley, on No. 2 foundry and malleable have withdrawn that quotation and are adhering to $15, the price that has ruled for weeks for next year's deliveries. Sales of about 10,000 tons of foundry and malleable have been made in this district in the past week. Bessemer and basic are strong, but without much activity. Predictions are more freely made that the pig-iron market will experience a sharp advance soon, as there are very few idle merchant furnaces, and the furnaces in blast have been reducing their stock piles, while prospects are that foundries will have larger requirements in future. We quote: Bessemer, $16; basic, malleable and foundry, $15; gray forge, $14.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The Jones & Laughlin Steel Co. has leased Josephine furnace at Kittanning, Penn., a merchant furnace stack rated at 300 tons of pig iron a day, and now idle, the intention being to transfer the manufacture of ferromanganese from one of the Aliquippa furnaces, giving the steel company so much more basic pig-iron capacity. The manufacture of ferromanganese from imported ores was started by the Jones & Laughlin Steel Co. last December. Contract deliveries by English producers have improved materially and further improvement is expected, so that buyers have less hesitancy in making fresh contracts at the $100 price quoted for some time. Domestic producers still adhere to their former quotation of $115 on contract. Odd lots for early shipment generally bring from $105 to $110.

Steel—A contract has been made for 4,500 tons of open-hearth sheet bars for delivery over the first six months of next year at a price equivalent to slightly more than $28, Pittsburgh mill, and it is reported that bessemer sheet bars have brought about $27, Pittsburgh, for first quarter. Very little is being done for such deliveries, while for early delivery there are no sellers, mills stating that the market is nominally $25 for bessemer and $26 for openhearth billets, with $1 advance for sheet bars. Rods are $32@33, Pittsburgh. There is considerable contract business for first half to be closed in the near future.

FERRO-ALLOYS

Ferromanganese is still quoted at $100 Baltimore for imported; $110@115 for domestic, early delivery.—**Ferrosilicon** is higher; bessemer 10% is quoted $21.50 at furnace for spot, $21.50 for first quarter and $22 for second quarter. Higher grades run up to $31 at furnace for 15% alloy.—**Ferrotitanium** is 8@12.5c. per lb., according to size of order and delivery.—**Ferrovanadium** $2@2.25 per lb. of contained vanadium.

IRON ORE

Shipments of Lake Superior ore are still heavy, and preparations are being made for a large demand through the winter.

Imports at Baltimore for the past week included 15,400 tons manganese ore from Brazil.

British Imports of Iron Ore nine months ended Sept. 30 were 4,527,970 long tons in 1914, and 4,700,046 in 1915; an increase of 172,076 tons.

Imports of manganese ore for the nine months were 406,765 long tons in 1914, and 209,814 in 1915; a decrease of 196,951 tons.

Exports of Manganese Ore from India for the four months of the fiscal year Apr. 1-July 31 were 245,086 tons in 1914, and 78,072 in 1915; decrease, 167,014 tons.

OTHER ORES

Molybdenite, 90% MoS_2, is quoted in London at 120s.—$28.80—per unit. The Australian government takes all the ore produced in that country at 105s. per unit—**Tungsten Ore** remains high, London quotations for wolframite, 65% WO_3, being 55s.—$13.20—per unit.

NEW CALEDONIA EXPORTS

Exports of nickel ore from New Caledonia, eight months ended July 31, were 39,216 metric tons. Exports of chrome ore were 28,828 tons. In July 14,189 tons chrome ore were shipped to New York. Exports of nickel matte were 1,709 tons.

COKE

Coke production of the Connellsville region for the past week is reported by the "Courier" at 421,091 short tons; shipments, 422,645 tons. Shipments of Greensburg and Upper Connellsville districts, 40,400 tons.

Coal and Coke Tonnage Pennsylvania R.R. lines east of Pittsburgh and Erie nine months ended Sept. 30, short tons:

	1914	1915	Changes
Anthracite	8,020,105	7,603,051	D. 417,054
Bituminous	33,864,642	31,678,900	D. 2,185,742
Coke	7,561,858	8,378,576	I. 816,718
Totals	49,446,605	47,660,527	D. 1,786,078

The total decrease was 3.6%. Coke alone shows an increase this year.

British Fuel Exports nine months ended Sept. 30, in long tons:

	1914	1915	Changes
Coal	48,116,349	33,414,212	D. 14,702,137
Coke	824,325	684,689	D. 139,636
Briquettes	1,431,938	960,636	D. 471,302
Steamer coal	14,581,962	10,722,894	D. 3,859,068
Total	64,954,574	45,782,431	D. 19,172,143

The steamer coal is the fuel furnished to steamships engaged in foreign trade.

SAULT STE. MARIE CANALS

Total freight passing through the Sault Canals in September was 10,974,557 short tons carried in 3,141 vessels. For the season to Oct. 1 the total freight was: East bound, 37,739,738; west bound, 10,643,865; total, 48,383,603 short tons. The number of vessel passages was 14,907, giving an average cargo of 3,246 tons. In all 12,139 vessels carrying 44,888,436 tons passed through the American locks; and 2,768, with 3,495,167 tons through the Canadian canals. The mineral freights included in the totals were, in short tons except salt, which is in barrels:

	1914	1915	Changes
Anthracite	1,589,501	1,448,734	D. 140,767
Bituminous coal	9,714,223	8,106,063	D. 1,608,160
Iron ore	25,923,002	33,761,762	I. 7,838,760
Pig and m'f'd iron	191,361	141,051	D. 50,310
Copper	47,237	95,373	I. 48,136
Salt, bbl.	565,736	481,170	D. 84,566

Iron ore was 69.8% and coal 19.7% of the total freight reported this year.

Chemicals

NEW YORK—Oct. 27

The general markets show an improved tone and more active business. The supposed discovery of a plot in New York to destroy or damage several large chemical manufacturing plants has caused a good deal of talk in the trade. How much of the reports have an actual base is still uncertain.

Arsenic—Little or no change is reported. Business is quiet. Quotations are $3.50 per 100 lb. for large lots and up to $4 per 100 lb. for smaller parcels.

Barytes—Exports from Baltimore for the past week included 61,920 lb. barytes to Manchester, England.

Copper Sulphate—Business continues fair and prices are steady, with no material charge. Current quotations are $6.50 per 100 lb. for carload lots, and $6.75 per 100 lb. for smaller parcels.

Nitrate of Soda—The market shows little change. Quotations remain about 2.45c. per lb. for both spot and futures.

The official statement of production of nitrate in Chile for the two months July 1-Aug. 31 gives a total of 6,365,022 quintals—288,131 long tons; a decrease of 4,187,742 quintals, or 39.7%, from last year.

Sulphuric Acid—Acid of 66°Bé. realizes $50@60 per ton in the seaboard markets in large lots. For 60°Bé.$30@35 is paid. These prices permit acid to be brought eastward from points so far west as Argentine, Kan., whence the freight rate is $11 per ton and still leave the producers a phenomenal profit.

PETROLEUM

Exports of mineral oils from the United States in August were 232,224,014 gal. For the eight months ended Aug. 31, the total exports were 1,493,937,331 gal. in 1914, and 1,518,884,770 gal. in 1915; an increase of 24,947,439 gal., or 1.7%, this year.

Assessments

Company	Delinqe	Sale	Amt.
Aetna, Ida.	Oct. 16	Nov. 15	0.001
Argenta, Ida.	Oct. 11	Nov. 13	0.001
Blue Bull Reorg., Nev.	Nov. 1	Dec. 6	0.01
Cash Boy, Nev.	Sept. 29	Oct. 30	0.01
Coeur d'Alene Inv., Ida.	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah.	Oct. 10	Oct. 30	0.025
Comstock, Ida.	Sept. 30	Oct. 30	0.001
Copper Mt. M. & D., Ida.	Oct. 28	Dec. 1	0.002
Danley-Lloyd, Utah.	Nov. 14	Nov. 30	0.0025
Diam'field Black Butte, Nev.	Oct. 4	Nov. 4	0.01
Eagle Mt., Ida.	Oct. 15	Nov. 15	0.0005
Eastern Star, Ida.	Oct. 29	Nov. 29	0.002
E. Hercules Ext., Ida. (post.)	.....	Nov. 11	0.0015
Enterprise, Ida.	Oct. 15	Nov. 15	0.002
Four Timbers, Wash.	Oct. 4	Nov. 4	0.001
Friend, Wash.	Oct. 18	Nov. 10	0.002
Giant M. & D., Ida.	Oct. 7	Nov. 8	0.003
Great Western, Nev.	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich.	Jan. 3	.....	1.00
Idaho-Nevada Exp., Ida.	Nov. 1	Dec. 1	0.002
Idora, Ida.	Oct. 11	Nov. 11	0.005
Lewis & Clark, Ida.	Oct. 15	Nov. 15	0.001
Lucky Swede, Ida.	Nov. 11	Dec. 11	0.002
Military M. & M., Ida.	Oct. 28	Nov. 29	0.0065
Montana Standard.	Nov. 15	Dec. 15	0.005
Nabob, Ida.	Oct. 25	Nov. 15	0.005
Nalldriver, Utah.	Oct. 9	Nov. 8	0.02
New Arcadian, Mich.	Dec. 1	.....	0.50
New Baltic, Mich.	Jan. 15	.....	0.50
Northern Light, Ida.	Nov. 2	Dec. 2	0.004
O. K. Ex. M. & R., Utah.	Nov. 20	Dec. 15	0.005
Old Veteam, Ida.	Nov. 1	Nov. 27	0.002
Ophir, Nev.	Oct. 12	Nov. 2	0.05
Oriental, Nev.	Nov. 6	Dec. 7	0.003
Original, Nev.	Nov. 6	Dec. 7	0.003
Pacific M. & M., Ida.	Nov. 10	Nov. 30	0.0005
Phoenix, Mich.	Jan. 1	.....	1.00
Ploche Metals, Nev.	Oct. 20	Nov. 20	0.00¼
Rainbow, Ida.	Oct. 15	Nov. 20	0.002
Royal, Ida.	Oct. 12	Nov. 9	0.0015
Silver Cliff, Ida.	Nov. 8	Dec. 6	0.0025
Silver Moon, Ida.	Oct. 15	Nov. 18	0.005
Silver Pick Cons., Nev.	Oct. 16	Nov. 23	0.01
Sunset M. & D., Nev.	Oct. 18	Nov. 22	0.02
Sunshine, Ida.	Oct. 15	Nov. 15	0.0006
Ton. Gipsy Queen, Nev.	Oct. 29	Dec. 6	0.01
Umatilla Ton., Nev.	Nov. 8	Dec. 13	0.005
Union Cons., Nev.	Oct. 25	Nov. 15	0.05
Wisconsin, Ida.	Oct. 19	Nov. 19	0.003
Wolf Mountain, Utah.	Nov. 12	Dec. 14	0.0025

Stock Quotations

Among sales at auction during the week ended Oct. 23 were: 10 Ala. & Ga. Iron Co. com. and 10 Ala. & Ga. Iron Co. pfd., $7 lot; 10 Horn Silver Mining, $25 par, $6 lot.

COLO. SPRINGS Oct. 26		SALT LAKE Oct. 25	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02½	Beck Tunnel	.05
Cripple Cr'k Con.	.008	Black Jack	‡.05½
C. K. & N.	‡.02	Colorado Mining	.05
Doctor Jack Pot.	.09½	Crown Point	.01½
Elkton Con.	.25	Daly-Judge	6.75
El Paso	.75	Emma Cop.	.27½
Findlay	.03½	Gold Chain	‡.16
Gold Dollar	.02½	Grand Central	.54
Gold Sovereign	.06½	Iron Blossom	.72
Golden Cycle	1.77	Lower Mammoth	‡.04½
Isabella	.16½	May Day	.19
Jack Pot	.06½	Opohongo	‡.00½
Jerry Johnson	.05½	Prince Con.	.68
Lexington	‡.005	Seven Troughs	.01½
Mary McKinney	.35	Silver King Coal'n	3.22½
Pharmacist	‡.008	Silver King Con.	2.00
Portland	1.68	Sioux Con.	.02
Raven B. H.	.03½	Uncle Sam	.07½
Vindicator	1.46	Yankee	‡.25

TORONTO Oct. 25			
Bailey	.03½	Dome Exten	.22
Chambers Ferland	.13	Dome Mines	27.25
Coniagas	3.60	Foley O'Brien	.35
Peterson Lake	.21	Hollinger	24.50
Right of Way	.02	Imperial	‡.05
Seneca Superior	‡.78	Jupiter	.11
Silver Queen	.01	McIntyre	.53½
T. & Hudson Bay	20.00	Pearl Lake	.00½
Timiskaming	.40	Porcu. Crown	.77
Trethewey	.13	Preston E. D.	‡.06
Wettlaufer-Lor.	.05	Rea	‡.09

SAN FRANCISCO Oct. 25			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.05	Belmont	3.60
Andes	.11	Jim Butler	.76
Best & Belcher	.10	Lone Star	.04
Caledonia	.98	MacNamara	.02
Challenge Con.	.08	Midway	.13
Chollar	.06	Mont.-Tonopah	.27
Confidence	.22	North Star	14.00
Con. Virginia	.29	Rescue Eula	.07
Gould & Curry	.06	West End Con.	.74
Hale & Norcross	.06	Atlanta	.24
Jacket-Cr. Pt.	.24	Booth	.35
Julia	.03	C.O.D. Con.	.04
Mexican	.42	Comb. Frac.	.07
Occidental	.78	D'field Daisy	.03
Ophir	.43	Jumbo Extension	1.35
Overman	.13	Pitts.-Silver Peak	.06
Potosi	.06	Round Mountain	.40
Savage	.10	Sandstorm Kendall	.10½
Sierra Nevada	.86	Silver Pick	.08
Union Con.	.76	Central Eureka	.10

N. Y. EXCH. Oct. 26	
Name of Comp.	Clg.
Am.Sm.&Ref.,com	93
Am. Sm. & Ref., pf.	109½
Am. Sm. Sec., pf. A	86¾
Am. Sm. Sec., pf. B.	82½
Anaconda	76½
Batopilas Min.	1½
Bethlehem Steel	580
Bethlehem Steel, pf.	180
Chino	50½
Colo. Fuel & Iron	58½
Crucible Steel	90
Federal M. & S., pf.	50½
Great Nor., ore., ctf.	50½
Greene Cananea	39
Guggen. Exp.	67½
Homestake	119½
Inspiration Con.	45
International Nickel	193½
Miami Copper	34½
Nat'l Lead, com.	67
National Lead, pf.	110½
Nev. Consol.	15½
Ontario Min.	3
Quicksilver	2½
Ray Con.	25½
Republic I&S, com.	54
Republic I&S, pf.	104
SlossSheffl'd, com.	60
Tennessee Copper	63½
Utah Copper	71
U. S. Steel, com.	85½
U. S. Steel, pf.	115½

N. Y. CURB Oct. 26	
Alaska Juneau	12½
Alta Con.	.22
Beaver Con.	.30
Big Four	.05
Blue Bell	.02
Braden Copper	10
Buffalo Mines	.50
Can. Cop. Corpn.	1 11/16
Cashboy	.08
Chile Cop.	23⅛
Con. Ariz. Sm.	1⅛
Con. Coppermines	1⅛
Con. Nev.-Utah	‡ 4/16
Dia. Black B.	.05
Florence	.44
Goldfield Con.	1⅛
Goldfield Merger	.19
Howe Sound	4⅛
Kennecott Cop.	53⅛
Kerr Lake	3⅛
La Rose	7/16
Magma	14⅛
McKinley-Dar-Sa.	.30
Mines of Am.	2⅛
Mother Lode	.35
Nevada Hills	.21
New Utah Bingham	2⅛
Nipissing Mines	6⅛
Oro	.06
St. Joseph Lead	14
South Utah	.25
Stand'd Oil of N.J.	486
Standard S. L.	1 9/16
Stewart	11/16
Success	.69
Tonopah	5 9/16
Tonopah Ex.	2 5/16
Tonopah Merger	.41
Tribullion	.50
Yukon Gold	2⅛

LONDON Oct. 11	
Alaska Tre'dwell	£6 7s 6d
Burma Corp.	1 9 3
Cam & Motor	0 14 0
Camp Bird	0 4 9
El Oro	0 7 6
Esperanza	0 7 6
Mexico Mines	3 11 3
Nechi, pfd.	0 12 6
Oroville	0 14 6
Santa Gert'dis	0 7 6
Tomboy	1 0 3
Tough Oakes	0 6 9

BOSTON EXCH Oct. 26	
Name of Comp.	Clg.
Adventure	1½
Ahmeek	396
Alaska Gold M.	33½
Algomah	2
Allouez	54
Am. Zinc	68¼
Ariz. Com., ctfs.	7⅛
Bonanza	.40
Butte-Balaklava	3½
Butte & Superior	65
Calumet & Ariz.	64
Calumet & Hecla	535
Centennial	17
Copper Range	56
Daly West	2½
East Butte	12½
Franklin	8½
Granby	84
Hancock	16½
Hedley	27
Helvetia	‡.50
Indiana	5
Island Cr'k, com.	43½
Island Cr'k, pfd.	87
Isle Royale	28
Keweenaw	2½
Lake	13½
La Salle	5½
Mason Valley	2
Mass	11
Mayflower	4
Michigan	2½
Mohawk	80
New Arcadian	10½
North Butte	29½
North Lake	1½
Ojibway	‡1½
Old Colony	3½
Old Dominion	53½
Osceola	83
Quincy	82
Santa Fe	4½
Shannon	7
Shattuck-Ariz.	28½
Superior	27
Superior & Bost.	2½
Tamarack	51
Trinity	8½
Tuolumne	.40
U. S. Smelting	43
U. S. Smelt'g, pf.	47
Utah Apex	2 11/16
Utah Con.	12½
Victoria	2½
Winona	3½
Wolverine	58½
Wyandot	1½

BOSTON CURB Oct. 26	
Bingham Mines	7½
Boston Ely	.21
Butte & Lon'n Dev.	.32
Calaveras	1½
Calumet-Corbin	.02
Chief Con.	.98
Cortez	.50
Crown Reserve	.38
Davis-Daly	1½
Eagle & Blue Bell	1½
First Nat. Cop.	5
Houghton Copper	2½
Iron Cap Cop., pf.	8½
Majestic	.65
Mexican Metals	.23
Nevada-Douglas	.65
New Baltic	2½
New Cornelia	8
Ohio Copper	.14
Oneco	1
Raven Copper	.14
Rex Cons.	.48
Smokey Dev.	.15
So. Lake	6
Tonopah Victor	.30
United Verde Ext.	5½
Utah Metal	9½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.499	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.383
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	.....	‡	.....
November	33.304	.....	139.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.560	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....